



NS9210 Processor Module

Hardware Reference

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This guide provides information about the Digi NS9210 Processor Module embedded core module.

Conventions used in this guide

This table describes the typographic conventions used in this guide:

This convention	Is used for
<i>italic type</i>	Emphasis, new terms, variables, and document titles.
monospaced type	Filenames, pathnames, and code examples.

Digi information

Related documentation

For additional documentation, see the Documentation folder under the Digi JumpStart kit Start menu tab.

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About the Module

C H A P T E R 1

The NS9210 Processor Module is part of the ConnectCore embedded core processor module family. Built on leading Digi technology, the network-enabled ConnectCore 9P family provides a modular and scalable core processor solution that significantly minimizes hardware and software design risk. This module combines superior performance and a complete set of integrated peripherals and component connectivity options in a compact and versatile form factor.

The NS9210 Processor Module is built around the NS9215 processor with a powerful ARM926EJ-S core. For further information about the NS9215, see the NS9215 Hardware Reference available through your Digi JumpStart Kit. The embedded module offers 8MB SDRAM and can support a maximum of 64MB SDRAM. The module has also 4MB NOR flash and can support up to a maximum of 16MB NOR flash, a single high speed serial peripheral interface (SPI) module, an I2C interface, UARTs, programmable flexible interface modules (FIMs), ADC, 16-bit data/17-bit address bus (buffered), and 64 shared GPIO signals for application-specific usage.

Features and functionality

- 32-bit NET+ARM (ARM926EJ-S) RISC processor NS9215 @ 150MHz
- ARM9 core with memory management unit (MMU)
- 4K data cache/4K instruction cache
- 8MB SDRAM (can support a maximum of 64MB SDRAM)
- 4MB NOR Flash (can support a maximum of 16MB NOR flash)
- 10 general purpose timers; NS9210 Processor Module supports 7 as timer/counters and one quadrature decoder
- 64 GPIOs signals with up to five different multiplexing schemes (all are on connector X2)
- Two 80-pin connectors
- Up to four UARTs
- One SPI channel, multiplexed on different places
- Integrated 10/100Mbps Ethernet MAC/PHY
- I²C interface
- JTAG signals available on module connector
- 8 ADC (analog to digital converter) inputs
- 2x flexible interface modules (FIMs) running at max. 300 MHz, integrated in NS9215 processor
- 2 LEDs (LE1: green, and LE2:orange) available on module
- 16-bit data and 17-bit address buses, both are buffered
- Single +3.3V power supply

Module variant

The NS9210 Processor Module is currently available in standard variants below.

Product numbers:	Features
CC-9P-V502-C	150 MHz CPU speed, 8MB SDRAM, 4 MB NOR flash, RTC, 10/100 Mbps Ethernet
CC-9P-V501-C	150 MHz CPU speed, 8MB SDRAM, 2MB NOR flash, RTC, 10/100 Mbps Ethernet

Module pinout

The module has two 80 pins connectors, X1 and X2. The next tables describe each pin, its properties, and its use on the development board.



Pinout legend: Type

- I Input
- O Output
- I/O Input or output
- P Power

X1 pinout

X1 pin number	Type	Module functionality	Usage on Development board	Comments
1	P	GND	GND	
2	P	GND	GND	
3	I	RSTIN#	RSTIN#	10k pull-up on module
4	O	PWRGOOD	PWRGOOD	Output of the reset controller push pull with 470R current limiting resistor
5	O	RSTOUT#	RSTOUT#	Output of logical AND function between NS9215 RESET_DONE and NS9215 RESET_OUT#
6	I	TCK	TCK	JTAG - 10k pull-up on module
7	I	TMS	TMS	JTAG - 10k pull-up on module
8	I	TDI	TDI	JTAG - 10k pull-up on module
9	O	TDO	TDO	JTAG - 10k pull-up on module
10	I	TRST#	TRST#	JTAG - 2k2 pull-up on module
11	O	RTCK	RTCK	JTAG - Optional
12	I	CONF2/OCD_EN#	CONF2/OCD_EN#	10k pull-up on module
13	I	LITTLE# / BIG ENDIAN	LITTLE# / BIG ENDIAN	2k2 series resistor on module
14	I	Reserved (WLAN_DISABLE#)	Reserved (WLAN_DISABLE#)	Low active WLAN Disable signal
15	I	SOFT_CONF0	SOFT_CONF0	2k2 series resistor on module
16	I	SOFT_CONF1	SOFT_CONF1	2k2 series resistor on module
17	I	SOFT_CONF2	SOFT_CONF2	2k2 series resistor on module
18	I	SOFT_CONF3	SOFT_CONF3	2k2 series resistor on module
19	O	Reserved (WLAN_LED#)	Reserved (WLAN_LED#)	Active low signal coming from Piper chip. This signal comes directly from the Piper chip without series resistor.

X1 pin number	Type	Module functionality	Usage on Development board	Comments
20	P	GND	GND	
21	I/O	D0	D0	Buffered Data - only active when either CS0# or CS2# is active NS9215 D[31:16]
22	I/O	D1	D1	
23	I/O	D2	D2	
24	I/O	D3	D3	
25	I/O	D4	D4	
26	I/O	D5	D5	
27	I/O	D6	D6	
28	I/O	D7	D7	
29	I/O	D8	D8	
30	I/O	D9	D9	
31	I/O	D10	D10	
32	I/O	D11	D11	
33	I/O	D12	D12	
34	I/O	D13	D13	
35	I/O	D14	D14	
36	I/O	D15	D15	
37	P	GND	GND	
38	O	AO	AO	Buffered Address always active
39	O	A1	A1	
40	O	A2	A2	
41	O	A3	A3	
42	O	A4	A4	
43	O	A5	A5	
44	O	A6	A6	
45	O	A7	A7	
46	O	A8	A8	
47	O	A9	A9	
48	O	A10	A10	
49	O	A11	A11	
50	O	A12	A12	



X1 pin number	Type	Module functionality	Usage on Development board	Comments
51	O	A13	A13	
52	O	A14	A14	
53	O	A15	A15	
54	O	A16	A16	
55	O	GND	GND	
56	O	EXT_OE#	EXT_OE#	
57	O	EXT_WE#	EXT_WE#	
58	O	CSO#	CSO#	
59	O	CS2#	CS2#	
60	O	BLE#	BLE#	NS9215 BE2#
61	O	BHE#	BHE#	NS9215 BE3#
62	I	EXT_WAIT#	EXT_WAIT#	10k pull-up on module
63	O	BCLK	BCLK	Connected over a 22R resistor to NS9215 CLK_OUT1 pin
64	P	GND	GND	
65	I	ETH_TPIN	ETH_TPIN	
66	O	ETH_ACTIVITY#	ETH_ACTIVITY#	Low active signal with 330R resistor on module
67	I	ETH_TPIP	ETH_TPIP	
68	O	ETH_LINK#	ETH_LINK	Low active signal with 330R resistor on module
69	O	ETH_TPON	ETH_TPON	
70	O	ETH_TROP	ETH_TROP	
71	P	GND	GND	
72	P	Reserved (USB_VBUS)	Reserved (USB_VBUS)	
73	I	Reserved (USB_OC#)	Reserved (USB_OC#)	
74	I/O	Reserved (USB_P)	Reserved (USB_P)	
75	I/O	Reserved (USB_N)	Reserved (USB_N)	
76	O	Reserved (USB_PWREN#)	Reserved (USB_PWREN#)	
77	I	Reserved (USB_OTG_ID)	Reserved (USB_OTG_ID)	

X1 pin number	Type	Module functionality	Usage on Development board	Comments
78	P	VRTC	VRTC	Backup Battery for RTC, for 3V cell. Can be left floating, if RTC backup not needed.
79	P	VLIO	VLIO	Mobile: Power from Li-Ion Battery (2.5V-5.5V) Non-Mobile: connected to 3.3V
80	P	GND	GND	

X2 pinout

X2 pin number	Type	Module functionality	Usage on Development board	Comments
1	P	GND		
2	P	GND		
3	I/O	DCDA#/ DMA0_DONE/ PIC_0_GEN_IO[0] GPIO0/ SPI_EN (dup)		
4	I/O	CTSA#/ EIRQ0/ PIC_0_GEN_IO[1] GPIO1/ -reserved-		
5	I/O	DSRA#/ EIRQ1/ PIC_0_GEN_IO[2] GPIO2/ -reserved-		
6	I/O	RXDA/ DMA0_PDEN/ PIC_0_GEN_IO[3] GPIO3/ SPI_RX (dup)		
7	I/O	RIA#/ EIRQ2/ Timer6_in/ GPIO4 SPI_CLK (dup)/		
8	I/O	RTSA#/ RS485CTLA EIRQ3/ Timer6_Out/ GPIO5/ SPI_CLK (dup)/		
9	I/O	DTRA#/ TXCLKA DMA0_REQ/ Timer7_In/ GPIO6/ PIC_DBG_DATA_OUT		

Chapter 1

X2 pin number	Type	Module functionality	Usage on Development board	Comments
10	I/O	TXDA/ Timer8_In/ Timer7_Out/ GPIO7/ SPI_TX (dup)		
11	I/O	DCDC#/ DMA1_DONE/ Timer8_Out/ GPIO8/ SPIB_EN (dup)/		
12	I/O	CTSC#/ I2C_SCK/ EIRQ0 (dup)/ GPIO9/ PIC_DBG_DATA_IN		
13	I/O	DSRC#/ QDCI/ EIRQ1 (dup) GPIO10/ PIC_DBG_CLK		
14	I/O	RXDC/ DMA1_DP/ EIRQ2 (dup)/ GPIO11/ SPI_RXboot		
15	I/O	RIC#/ RXCLKC I2C_SDA/ RST_DONE/ GPIO12/ SPI_CLK (dup)		When booting, NS9215 RIC# signal is default configured as Output, RST_DONE. To avoid input/output conflicts, put a series resistor on this signal if necessary.
16	I/O	RTSC#/ QDCQ/ Ext Timer Event Out Ch 9/ GPIO13/ SPI_CLKboot		
17	I/O	DTRC#/ TXCLKC DMA1_REQ/ PIC_0_CAN_RXD GPIO14/ SPI_TXDboot		

X2 pin number	Type	Module functionality	Usage on Development board	Comments
18	I/O	TXDC/ Timer9_In/ PIC_0_CAN_TXD GPIO15/ SPI_ENboot		
19	I/O	DCDB# (dup)/ PIC_0_BUS_1[8] PIC_1_BUS_1[8] GPIO51/		
20	I/O	CTSB# (dup)/ PIC_0_BUS_1[9] PIC_1_BUS_1[9] GPIO52/		
21	I/O	DSRB# (dup)/ PIC_0_BUS_1[10] PIC_1_BUS_1[10] GPIO53/		
22	I/O	RXDB (dup)/ PIC_0_BUS_1[11] PIC_1_BUS_1[11] GPIO54/		
23	I/O	RIB# (dup)/ PIC_0_BUS_1[12] PIC_1_BUS_1[12] GPIO55/		
24	I/O	RTSB# (dup) / RS485CTLB (dup) / PIC_0_BUS_1[13] PIC_1_BUS_1[13] GPIO56/		
25	I/O	TXCLKB (dup) / DTRB# (dup) / PIC_0_BUS_1[14] PIC_1_BUS_1[14] GPIO57/		
26	I/O	TXDB (dup)/ PIC_0_BUS_1[15] PIC_1_BUS_1[15] GPIO58/		

X2 pin number	Type	Module functionality	Usage on Development board	Comments
27	I/O	DCDD# (dup) / PIC_0_BUS_1[16] PIC_1_BUS_1[16] GPIO59/		
28	I/O	CTSD# (dup)/ PIC_0_BUS_1[17] PIC_1_BUS_1[17] GPIO60/		
29	I/O	DSRD# (dup)/ PIC_0_BUS_1[18] PIC_1_BUS_1[18] GPIO61/		
30	I/O	RXDD (dup)/ PIC_0_BUS_1[19] PIC_1_BUS_1[19] GPIO62/		
31	I/O	RID# (dup)/ PIC_0_BUS_1[20] PIC_1_BUS_1[20] GPIO63/		
32	I/O	RTSD# (dup) / RS485CTLD(dup) / PIC_0_BUS_1[21] PIC_1_BUS_1[21] GPIO64/		
33	I/O	TXCLKD (dup) / DTRD# (dup) / PIC_0_BUS_1[22] PIC_1_BUS_1[22] GPIO65		
34	I/O	TXDD (dup) / PIC_0_BUS_1[23] PIC_1_BUS_1[23] GPIO66		
35	I/O	PIC_0_CLK[I] PIC_0_CLK[0] EIRQ3 (dup)/ GPIO67		
36	I/O	PIC_0_GEN_IO[0] PIC_1_GEN_IO[0] PIC_1_CAN_RXD GPIO68		

X2 pin number	Type	Module functionality	Usage on Development board	Comments
37	I/O	PIC_0_GEN_IO[1] PIC_1_GEN_IO[1] PIC_1_CAN_TXD GPIO69		
38	I/O	PIC_0_GEN_IO[2] PIC_1_GEN_IO[2] PWM0/ GPIO70		
39	I/O	PIC_0_GEN_IO[3] PIC_1_GEN_IO[3] PWM1/ GPIO71		
40	I/O	PIC_0_GEN_IO[4] PIC_1_GEN_IO[4] PWM2/ GPIO72		
41	I/O	PIC_0_GEN_IO[5] PIC_1_GEN_IO[5] PWM3/ GPIO73		
42	I/O	PIC_0_GEN_IO[6] PIC_1_GEN_IO[6] Timer0_In/ GPIO74		
43	I/O	PIC_0_GEN_IO[7] PIC_1_GEN_IO[7] Timer1_In/ GPIO75		
44	I/O	PIC_0_CTL_IO[0] PIC_1_CTL_IO[0] Timer2_In/ GPIO76		
45	I/O	PIC_0_CTL_IO[1] PIC_1_CTL_IO[1] Timer3_In/ GPIO77		
46	I/O	PIC_0_CTL_IO[2] PIC_1_CTL_IO[2] Timer4_In/ GPIO78		

X2 pin number	Type	Module functionality	Usage on Development board	Comments
47	I/O	PIC_0_CTL_IO[3] PIC_1_CTL_IO[3] Timer5_In/ GPIO79		
48	I/O	PIC_0_BUS_0[0] PIC_1_BUS_0[0] Timer6_In (dup)/ GPIO80		
49	I/O	PIC_0_BUS_0[1] PIC_1_BUS_0[1] Timer7_In (dup)/ GPIO81		
50	I/O	PIC_0_BUS_0[2] PIC_1_BUS_0[2] Timer8_In (dup)/ GPIO82		
51	I/O	PIC_0_BUS_0[3] PIC_1_BUS_0[3] Timer9_In (dup)/ GPIO83		
52	I/O	PIC_0_BUS_0[4] PIC_1_BUS_0[4] Timer0_Out/ GPIO84		
53	I/O	PIC_0_BUS_0[5] PIC_1_BUS_0[5] Timer1_Out/ GPIO85		
54	I/O	PIC_0_BUS_0[6] PIC_1_BUS_0[6] Timer2_Out/ GPIO86		
55	I/O	PIC_0_BUS_0[7] PIC_1_BUS_0[7] Timer3_Out/ GPIO87		
56	I/O	PIC_0_BUS_0[13]/ PIC_1_BUS_0[13]/ Timer9_Out (dup)/ GPIO93		

X2 pin number	Type	Module functionality	Usage on Development board	Comments
57	I/O	PIC_0_BUS_0[14]/ PIC_1_BUS_0[14]/ QDCI (dup)/ GPIO94		
58	I/O	PIC_0_BUS_0[15]/ PIC_1_BUS_0[15]/ QDCQ (dup)/ GPIO95		
59	I/O	PIC_0_BUS_1[0]/ PIC_1_BUS_1[0]/ PIC_0_CAN_RXD GPIO96		
60	I/O	PIC_0_BUS_1[1]/ PIC_1_BUS_1[1]/ PIC_0_CAN_TXD GPIO97		
61	I/O	PIC_0_BUS_1[2]/ PIC_1_BUS_1[2]/ PIC_1_CAN_RXD GPIO98		
62	I/O	PIC_0_BUS_1[3]/ PIC_1_BUS_1[3]/ PIC_1_CAN_TXD GPIO99		
63	I/O	PIC_0_BUS_1[4]/ PIC_1_BUS_1[4]/ PWM4/ GPIO100		
64	I/O	PIC_0_BUS_1[5]/ PIC_1_BUS_1[5]/ EIRQ3/ GPIO101		
65	I/O	PIC_0_BUS_1[6]/ PIC_1_BUS_1[6]/ I2C_SCL (dup)/ GPIO102		4k7 pull-up on module
66	I/O	PIC_0_BUS_1[7]/ PIC_1_BUS_1[7]/ I2C_SDA (dup)/ GPIO103		4k7 pull-up on module

X2 pin number	Type	Module functionality	Usage on Development board	Comments
67	I	VIN0_ADC		
68	I	VIN1_ADC		
69	I	VIN2_ADC		
70	I	VIN3_ADC		
71	I	VIN4_ADC		
72	I	VIN5_ADC		
73	I	VIN6_ADC		
74	I	VIN7_ADC		
75	P	VSS_ADC		Connected on module to AGND through 0Ω resistor
76	P	VREF_ADC		100nF decoupling capacitor between VREF_ADC and VSS_ADC
77	P	3.3V		
78	P	3.3V		
79	P	GND		
80	P	GND		

Configuration pins – CPU

None of the 64 GPIO pins on connector X2 disturb CPU boot strap functions. The boot strap functions are controlled by address signals; the user can not disturb boot strap functions from outside, if the module configuration signals, described below, are correctly configured.

Default module CPU configuration

The user has access to six configuration signals:

- LITTLE#/BIG_ ENDIAN which allows the user to select the endianness of the module
- OCD_EN# which allows the user to activate on-chip debugging
- SW_CONF [3:0] which are reserved for the user; the user software can read out these signals through the GEN ID register (@ 0xA090_0210).

Configuration pins – Module

The NS9210 Processor Module supports the following JTAG signals: TCK, TMS, TDI, TDO, TRST#, and RTCK. Selection can be made between ARM debug mode and boundary scan mode with the signal OCD_EN#.

Identification of the module

In order to make it easier for software to recognize a module and especially a hardware variant of the module, a specific bit field made of 4-bits has been reserved on the module. This bit field can be read out through GEN ID register and correspond to A[12:9]. These configuration signals use the internal CPU pull-up resistor and can be pulled down through external population option 2k2 resistors.

In the same way, 3 bits have been available on the module to identify the SDRAM configuration scheme. This bits correspond to A[19:17]. It is impossible for the user to disturb either the variant specific or SDRAM configuration specific bits from outside.

The NS9210 Processor Module has also available 4-bit for platform identification. This bit field can be read out through GEN ID register and correspond to A[16:13]. Configuration of these signals is done through the SW_CONF pins. SW_CONF0 is connected to A13 through a 2k2 series resistor, and so on for the further SW_CONF pins. So this bit can be set high by leaving the corresponding SW_CONF pin unconnected and set low by connecting the corresponding SW_CONF pin directly low. The user can benefit from these pins to support application or platform specific software configurations.

Module pin configuration

Signal name	Function	PU/PD	Comment
LITTLE#/BIG_ENDIAN	Set module endianness. 0 module boots in little endian mode. 1 module boots in big endian mode.	PU	Signal LITTLE#/BIG_ENDIAN is connected to GPIO_A3/A27 through a 2k2 series resistor.
OCD_EN#	JTAG / Boundary scan function select 0 ARM debug mode, BISTEN# set to high 1 Boundary scan mode, BISTEN# set to low	PU 10K	
SW_CONF0	User-defined software configuration pin; can be read in GEN_ID register bit 4, default high		Connected to A13 through a 2k2 series resistor. Read bit 4 of GEN ID register (@ 0xA0900210).

Signal name	Function	PU/PD	Comment
SW_CONF1	User-defined software configuration pin; can be read in GEN ID register bit 5, default high		Connected to A14 through a 2k2 series resistor. Read bit 5 of GEN ID register (@ 0xA0900210).
SW_CONF2	User-defined software configuration pin; can be read in GEN ID register bit 6, default high		Connected to A15 through a 2k2 series resistor. Read bit 6 of GEN ID register (@ 0xA0900210).
SW_CONF3	User-defined software configuration pin; can be read in GEN ID register bit 7, default high		Connected to A16 through a 2k2 series resistor. Read bit 7 of GEN ID register (@ 0xA0900210).

Clock generation

Clock frequencies

Hardware strapping determines the initial powerup PLL settings. The table below summarizes the default clock frequencies for the NS9210 Processor Module:

Hardware strapping:

"PLL reference clock divider setting:

A[4:0] = 0x1D (0b11101)

NR = 5

"PLL output divider setting:

A[6:5] = 0x3 (0b11)

OD = 0

"PLL bypass setting:

A[7] = 0x1 (0b1)

Normal operation

PLL frequency formula:

$PLL\ V_{co} = (RefClk / NR + 1) * (NF + 1)$

$ClkOut = PLL\ V_{co} / (OD + 1)$

RefClk (Crystal) = 29.4912MHz

NF = 0x3C (reset value - can only be changed by software).

$PLL\ V_{co} = (29.4912 / 6) * 61 = 299.8272\ MHz$

ClkOut = 299.8272 MHz

Resulting clock settings:

PIC clock = 299.8272 MHz

CPU clock = 299.8272 MHz / 2 = 149.9136 MHz

AHB clock = 149.9136 MHz / 2 = 74.9568 MHz

Changing the CPU speed

After powerup, software can change the PLL settings by writing to the PLL configuration register (@ 0xA090_0188)

Important: When PLL parameters are changed, a reset is provided for the PLL to stabilize. Applications using this feature need to be aware the SDRAM contents will be lost. See reset behavior in the table below.

Reset Behavior	RESET _n pin	SRESET _n pin	PLL Config Reg. Update	Watchdog Time-Out Reset
SPI boot	YES	YES	YES	YES
Strapping PLL	YES	NO	NO	NO
Other strappings (Endianess)	YES	NO	NO	NO
GPIO configuration	YES	NO	NO	NO
Other (ASIC) registers	YES	YES	YES	YES
SDRAM keeps its contents	NO	YES	NO	YES

Boot process

The NS9210 Processor Module boots directly from NOR flash. The start-up code is located at address 0x00000000 during the boot process. When the system is booted, the SDRAM is remapped to address 0x00000000 and Nor Flash to 0x50000000 by modifying the address map in the AHB decoder.

Chip selects

The module has eight chip selects: four for dynamic memory and four for static memory. Each chip select has a 256MB range.

Chip select memory map

Name	CPU Sig. name	Pin	Address range	Size [Mb]	Usage	Comments
SDM_CS0#	CS1#	D6	0x00000000–0x0FFFFFFF	256	SDRAM bank 0	First bank on module
SDM_CS1#	CS3#	B5	0x10000000–0x1FFFFFFF	256	not used	
SDM_CS2#	CS5#	A4	0x20000000–0x2FFFFFFF	256	not used	
SDM_CS3#	CS7#	B4	0x30000000–0x3FFFFFFF	256	not used	
EXT_CS0#	CS0#	C6	0x40000000–0x4FFFFFFF	256	external, CS0#	
INT_CS1#	CS2#	B6	0x50000000–0x5FFFFFFF	256	NOR-Flash	Program memory on module
EXT_CS2#	CS4#	C5	0x60000000–0x6FFFFFFF	256	external, CS2#	
INT_CS3#	CS6#	A3	0x70000000–0x7FFFFFFF	256	internal, CS3#	Reserved for internal usage

SDRAM banks

The module provides connection to 1 SDRAM chip, connected to CS1# (SDM_CS0#). The other SDRAM chip selects are not used.

The standard module has one of these SDRAM onboard: 1Mx16x4-banks. A13 is the highest address connected. BA0 and BA1 are connected to A21 and A22, respectively.

Multiplexed GPIO pins

The 64 GPIOs pins available on the module connector are multiplexed with other functions like:

- UART
- SPI
- Ethernet
- DMA
- I²C port
- Timers and interrupt inputs
- Memory bus data

Pin notes

- GPIO [15:0] allow five multiplex modes.
- GPIO [103:16] and GPIO_A [3:0] have four multiplex modes.
- Using a pin as GPIO means always to give up other functionalities. Some functions are duplicated to enhance the chance to use them without giving up other vital functions.
- Using original and (dup) functions in parallel is not recommended.
- Default function of GPIOs after CPU power up is function 03, except GPIO12 (function 02-reset_done) and GPIO [31:16] (function 00 - DATA[15:0]).

GPIO multiplex table

In the GPIO multiplex table below,

- the default function is written bold,
- # means low active signal,
- (dup) means function is available multiple times.

Port name, Function 03	Alternate function 00	Alternate function 01	Alternate function 02	Alternate function 04 (only GPIO00...GPIO15)	On module, default used as
GPIO0	DCDA#	DMA0_DONE	PIC_0_GEN_IO[0]	SPI_EN# (dup)	DCDA# / SPI_EN#
GPIO1	CTSA#	EIRQ0	PIC_0_GEN_IO[1]	Reserved	CTSA#
GPIO2	DSRA#	EIRQ1	PIC_0_GEN_IO[2]	Reserved	DSRA#
GPIO3	RXDA#	DMA0_PDEN	PIC_0_GEN_IO[3]	SPI_RXD (dup)	RXDA / SPI_RXD
GPIO4	RIA#	EIRQ2	Timer6_In	SPI_CLK (dup)	RIA# / SPI_CLK
GPIO5	RTSA# / 485CTLA	EIRQ3	Timer6_Out	SPI_CLK (dup)	RTSA#
GPIO6	TXCLKA / DTRA#	DMA0_REQ	Timer7_In	PIC_DBG_DATA_OUT	DTRA#
GPIO7	TXDA	Timer8_In	Timer7_Out	SPI_TXD (dup)	TXDA / SPI_TXD
GPIO8	DCDC# / TXCLKC	DMA1_DONE	Timer8_Out	SPI_EN# (dup)	DCDC#
GPIO9	CTSC#	I2C_SCL	EIRQ0 (dup)	PIC_DBG_DATA_IN	CTSC#
GPIO10	DSRC#	QDCI	EIRQ1 (dup)	PIC_DBG_CLK	DSRC#



Port name, Function 03	Alternate function 00	Alternate function 01	Alternate function 02	Alternate function 04 (only GPIO00...GPIO15)	On module, default used as
GPIO11	RXDC#	DMA1_PDEN	EIRQ2 (dup)	SPI_RXD (boot)	RXDC
GPIO12	RXCLKC / RIC#	I2C_SDA	RESET_DONE	SPI_CLK (dup)	RIC# ¹
GPIO13	RXCLKC / RTSC# /485CTLC	QDCQ	Reserved	SPI_CLK (boot)	RXCLKC / RTSC#
GPIO14	TXCLKC / DTRC#	DMA1_REQ	PIC_0_CAN_RXD	SPI_TXD (boot)	TXCLKC
GPIO15	TXDC	Timer9_In	PIC_0_CAN_TXD	SPI_EN# (boot)	TXDC
GPIO16	D0	DCDB#	EIRQ0 (dup)		Reserved for upper data lines
GPIO17	D1	CTSB#	EIRQ1 (dup)		Reserved for upper data lines
GPIO18	D2	DSRB#	EIRQ2 (dup)		Reserved for upper data lines
GPIO19	D3	RXDB	EIRQ3 (dup)		Reserved for upper data lines
GPIO20	D4	RIB#	DMA0_DONE (dup)		Reserved for upper data lines
GPIO21	D5	RTSB# / 485CTLB	DMA0_PDEN (dup)		Reserved for upper data lines
GPIO22	D6	TXCLKB / DTRB#	DMA1_DONE (dup)		Reserved for upper data lines
GPIO23	D7	TXDB	PIC_1_CAN_RXD		Reserved for upper data lines
GPIO24	D8	DCDD#	PIC_1_CAN_TXD		Reserved for upper data lines
GPIO25	D9	CTSD#	RESET_DONE (dup)		Reserved for upper data lines
GPIO26	D10	DSRD#	PIC_1_GEN_IO[0]		Reserved for upper data lines
GPIO27	D11	RXDD	PIC_1_GEN_IO[1]		Reserved for upper data lines
GPIO28	D12	RID#	PIC_1_GEN_IO[2]		Reserved for upper data lines
GPIO29	D13	RTSD# / 485CTLD	PIC_1_GEN_IO[3]		Reserved for upper data lines
GPIO30	D14	TXCLKD / DTRD#	Reserved		Reserved for upper data lines

Chapter 1

Port name, Function 03	Alternate function 00	Alternate function 01	Alternate function 02	Alternate function 04 (only GPIO00...GPIO15)	On module, default used as
GPIO31	D15	TXDD	Reserved		Reserved for upper data lines
GPIO32	MII_MDC	PIC_0_GEN_IO[0]	Reserved		MII Interface
GPIO33	MII_TXC	PIC_0_GEN_IO[1]	Reserved		MII Interface
GPIO34	MII_RXC	PIC_0_GEN_IO[2]	Reserved		MII Interface
GPIO35	MII_MDIO	PIC_0_GEN_IO[3]	Reserved		MII Interface
GPIO36	MII_RXDV	PIC_0_GEN_IO[4]	Reserved		MII Interface
GPIO37	MII_RXER	PIC_0_GEN_IO[5]	Reserved		MII Interface
GPIO38	MII_RXD0	PIC_0_GEN_IO[6]	Reserved		MII Interface
GPIO39	MII_RXD1	PIC_0_GEN_IO[7]	Reserved		MII Interface
GPIO40	MII_RXD2	PIC_1_GEN_IO[0]	Reserved		MII Interface
GPIO41	MII_RXD3	PIC_1_GEN_IO[1]	Reserved		MII Interface
GPIO42	MII_TXEN	PIC_1_GEN_IO[2]	Reserved		MII Interface
GPIO43	MII_TXER	PIC_1_GEN_IO[3]	Reserved		MII Interface
GPIO44	MII_TXD0	PIC_1_GEN_IO[4]	Reserved		MII Interface
GPIO45	MII_TXD1	PIC_1_GEN_IO[5]	Reserved		MII Interface
GPIO46	MII_TXD2	PIC_1_GEN_IO[6]	Reserved		MII Interface
GPIO47	MII_TXD3	PIC_1_GEN_IO[7]	Reserved		MII Interface
GPIO48	MII_COL	Reserved	Reserved		MII Interface
GPIO49	MII_CRS	Reserved	Reserved		MII Interface
GPIO50	MII_PHY_Int	PIC_1_CLK (I)	PIC_1_CLK(0)		MII Interface
GPIO51	DCDB# (dup)	PIC_0_BUS_1[8]	PIC_1_BUS_1[8]		DCDB#
GPIO52	CTSB# (dup)	PIC_0_BUS_1[9]	PIC_1_BUS_1[9]		CTSB#
GPIO53	DSRB# (dup)	PIC_0_BUS_1[10]	PIC_1_BUS_1[10]		DSRB#
GPIO54	RXDB (dup)	PIC_0_BUS_1[11]	PIC_1_BUS_1[11]		RXDB
GPIO55	RIB# (dup)	PIC_0_BUS_1[12]	PIC_1_BUS_1[12]		RIB#
GPIO56	RTSB# / 485CTLB (dup)	PIC_0_BUS_1[13]	PIC_1_BUS_1[13]		RTSB#
GPIO57	TXCLKB (dup) / DTRB# (dup)	PIC_0_BUS_1[14]	PIC_1_BUS_1[14]		DTRB#
GPIO58	TXDB (dup)	PIC_0_BUS_1[15]	PIC_1_BUS_1[15]		TXDB
GPIO59	DCDD# (dup)	PIC_0_BUS_1[16]	PIC_1_BUS_1[16]		DCDD#
GPIO60	CTSD# (dup)	PIC_0_BUS_1[17]	PIC_1_BUS_1[17]		CTSD#



Port name, Function 03	Alternate function 00	Alternate function 01	Alternate function 02	Alternate function 04 (only GPIO00...GPIO15)	On module, default used as
GPIO61	DSRD# (dup)	PIC_0_BUS_1[18]	PIC_1_BUS_1[18]		DSRD#
GPIO62	RXDD (dup)	PIC_0_BUS_1[19]	PIC_1_BUS_1[19]		RXDD
GPIO63	RID# (dup)	PIC_0_BUS_1[20]	PIC_1_BUS_1[20]		RID#
GPIO64	RTSD# / 485CTLD (dup)	PIC_0_BUS_1[21]	PIC_1_BUS_1[21]		RTSD#
GPIO65	TXCLKD (dup) / DTRD# (dup)	PIC_0_BUS_1[22]	PIC_1_BUS_1[22]		DTRD#
GPIO66	TXDD (dup)	PIC_0_BUS_1[23]	PIC_1_BUS_1[23]		TXDD
GPIO67	PIC_0_CLK (I)	PIC_0_CLK (O)	EIRQ3 (dup)		PIC_0_CLK
GPIO68	PIC_0_GEN_IO[0]	PIC_1_GEN_IO[0]	PIC_1_CAN_RXD		PIC_0_GEN_IO[0]
GPIO69	PIC_0_GEN_IO[1]	PIC_1_GEN_IO[1]	PIC_1_CAN_TXD		PIC_0_GEN_IO[1]
GPIO70	PIC_0_GEN_IO[2]	PIC_1_GEN_IO[2]	PWM0		PIC_0_GEN_IO[2]
GPIO71	PIC_0_GEN_IO[3]	PIC_1_GEN_IO[3]	PWM1		PIC_0_GEN_IO[3]
GPIO72	PIC_0_GEN_IO[4]	PIC_1_GEN_IO[4]	PWM2		PIC_0_GEN_IO[4]
GPIO73	PIC_0_GEN_IO[5]	PIC_1_GEN_IO[5]	PWM3		PIC_0_GEN_IO[5]
GPIO74	PIC_0_GEN_IO[6]	PIC_1_GEN_IO[6]	Timer0_In		PIC_0_GEN_IO[6]
GPIO75	PIC_0_GEN_IO[7]	PIC_1_GEN_IO[7]	Timer1_In		PIC_0_GEN_IO[7]
GPIO76	PIC_0_CTL_IO[0]	PIC_1_CTL_IO[0]	Timer2_In		PIC_0_CTL_IO[0]
GPIO77	PIC_0_CTL_IO[1]	PIC_1_CTL_IO[1]	Timer3_In		PIC_0_CTL_IO[1]
GPIO78	PIC_0_CTL_IO[2]	PIC_1_CTL_IO[2]	Timer4_In		PIC_0_CTL_IO[2]
GPIO79	PIC_0_CTL_IO[3]	PIC_1_CTL_IO[3]	Timer5_In		PIC_0_CTL_IO[3]
GPIO80	PIC_0_BUS_0[0]	PIC_1_BUS_0[0]	Timer6_In (dup)		Timer6_In
GPIO81	PIC_0_BUS_0[1]	PIC_1_BUS_0[1]	Timer7_In (dup)		Timer7_In
GPIO82	PIC_0_BUS_0[2]	PIC_1_BUS_0[2]	Timer8_In (dup)		Timer8_In
GPIO83	PIC_0_BUS_0[3]	PIC_1_BUS_0[3]	Timer9_In (dup)		Timer9_In
GPIO84	PIC_0_BUS_0[4]	PIC_1_BUS_0[4]	Timer0_Out		Timer0_Out
GPIO85	PIC_0_BUS_0[5]	PIC_1_BUS_0[5]	Timer1_Out		Timer1_Out
GPIO86	PIC_0_BUS_0[6]	PIC_1_BUS_0[6]	Timer2_Out		Timer2_Out
GPIO87	PIC_0_BUS_0[7]	PIC_1_BUS_0[7]	Timer3_Out		Timer3_Out
GPIO88	PIC_0_BUS_0[8]	PIC_1_BUS_0[8]	Timer4_Out		Reserved for module LEDs
GPIO89	PIC_0_BUS_0[9]	PIC_1_BUS_0[9]	Timer5_Out		Reserved for module LEDs

Port name, Function 03	Alternate function 00	Alternate function 01	Alternate function 02	Alternate function 04 (only GPIO00...GPIO15)	On module, default used as
GPIO90	PIC_0_BUS_0[10]	PIC_1_BUS_0[10]	Timer6_Out (dup)		GPIO reserved on module
GPIO91	PIC_0_BUS_0[11]	PIC_1_BUS_0[11]	Timer7_Out (dup)		Reserved NAND_R/B#
GPIO92	PIC_0_BUS_0[12]	PIC_1_BUS_0[12]	Timer8_Out (dup)		GPIO reserved on module
GPIO93	PIC_0_BUS_0[13]	PIC_1_BUS_0[13]	Timer9_Out (dup)		Timer9_Out
GPIO94	PIC_0_BUS_0[14]	PIC_1_BUS_0[14]	QDCI (dup)		QDCI
GPIO95	PIC_0_BUS_0[15]	PIC_1_BUS_0[15]	QDCQ (dup)		QDCQ
GPIO96	PIC_0_BUS_1[0]	PIC_1_BUS_1[0]	PIC_0_CAN_RXD		PIC_0_CAN_RXD
GPIO97	PIC_0_BUS_1[1]	PIC_1_BUS_1[1]	PIC_0_CAN_TXD		PIC_0_CAN_TXD
GPIO98	PIC_0_BUS_1[2]	PIC_1_BUS_1[2]	PIC_1_CAN_RXD		PIC_1_CAN_RXD
GPIO99	PIC_0_BUS_1[3]	PIC_1_BUS_1[3]	PIC_1_CAN_TXD		PIC_1_CAN_TXD
GPIO100	PIC_0_BUS_1[4]	PIC_1_BUS_1[4]	PWM4		PWM4
GPIO101	PIC_0_BUS_1[5]	PIC_1_BUS_1[5]	EIRQ3		EIRQ3
GPIO102	PIC_0_BUS_1[6]	PIC_1_BUS_1[6]	I2C_SCL (dup)		I2C_SCL
GPIO103	PIC_0_BUS_1[7]	PIC_1_BUS_1[7]	I2C_SDA (dup)		I2C_SDA
GPIO_A0	A24	I2C_SCL dupe	EIRQ0 (dup)		Reserved EIRQ0 - Piper
GPIO_A1	A25	I2C_SDA dupe	EIRQ1 (dup)		Reserved EIRQ1 - USB
GPIO_A2	A26	CS0_WE#	EIRQ2 (dup)		GPIO reserved on module
GPIO_A3	A27	CS0_OE#	UART_REFCLK		Little/Big Endian

¹ Put a series resistor on the baseboard in this case to avoid input/output conflict between RESET_DONE (output/boot default) and RIC# (input/configuration default).

External interrupts

The NS9210 Processor Module provides access to four external interrupts signals, which are multiplexed with other functions on the GPIO pins. Every interrupt is multiplexed to two or three different GPIO pins. These duplicate signals are marked as *(dup)* in the GPIO table.

External interrupt	GPIO multiplexing	Other functions, 1st position	Comments
EIRQ0	GPIO1	X2.4	
	GPIO9	X2.12	
EIRQ1	GPIO2	X2.5	
	GPIO10	X2.13	

External interrupt	GPIO multiplexing	Other functions, 1st position	Comments
EIRQ2	GPIO4	X2.7	
	GPIO11	X2.14	
EIRQ3	GPIO5	X2.8	EIRQ3# is used on the development board to implement I ² C I/O expander interrupt functionality.
	GPIO67	X2.35	
	GPIO101	X2.64	

Interfaces

10/100 Mbps Ethernet port

The NS9215 10/100 Mbps Ethernet MAC allows a glueless connection of a 3.3V MII PHY chip that generates the physical Ethernet signals.

The module has a MII PHY chip (ICS ICS1893BKILFT) in a 56-pin QFN package on board. By default, the module does not have a transformer or Ethernet connector; the base board must provide these parts. However, it's possible to populate a specific RJ45 connector with magnetics on the module. The appropriate RJ-45 is Midcom MIC2412A-5108W-LF3.

A PHY clock of 25 MHz is generated in the PHY chip with a 25 MHz crystal.

GPIO90 is controlling the PHY RESET# signal. This GPIO has a 2k2 pull-down resistor to GND populated on the module. GPIO90 must be asserted high before PHY can be used. When not used, the PHY can be put in low-power mode by asserting GPIO90 low.

The PHY address on the MII bus is 0x7 (0b00111).

The module does not only provide access to the Ethernet signals coming out of the PHY, but supports also two status LEDs: ETH_ACTIVITY# and ETH_LINK#.

UART

The module provides up to four UART ports with all handshake signals, used in asynchronous mode:

- Port A = GPIO0 through GPIO7
- Port B = GPIO51 through GPIO58
- Port C = GPIO8 through GPIO15
- Port D = GPIO59 through GPIO66

The module supports baud rates up to 1.8432 Mbps in asynchronous mode. Each UART has a 64-byte TX and RX FIFO available.

SPI

The module provides one SPI port which can be used in either master or slave mode.

- Master: 33.33 Mbps
- Slave: 7.50 Mbps

The SPI module is made of four signals: RXD, TXD, CLK and CS#

I²C bus

The I²C bus is completely free on the module - no EEPROM and no RTC - since the RTC is in the processor.

The I²C clock is max 400kHz.

I²C signals are provided on the module with 4k7 pull-up resistors.

RTC

The RTC is integrated in the processor and has its own 32.768 KHz clock crystal.

- When powered by VBAT, RTC unit will function until VBAT (X1.78) reaches a threshold of 2.3 - 2.4V - then the internal unit switches off.
- The battery current without +3.3V power applied is up to 40µA. The current is used to power the RTC, 32.768kHz oscillator and 64-byte internal RAM.
- When the development board ships from the factory the battery is disabled. To enable the battery, place a jumper on the development board at J2.

Power

Power supply

The module has +3.3V and VLIO supply pins.

VLIO can be connected either to a Li-Ion battery (2.5V - 5.5V) in a mobile application, or it can be connected directly to +3.3V. Connecting VLIO to a battery causes efficiency to be gained without an additional voltage regulator.

Internal voltage

The internal 1.8V core voltage is generated through a high-efficiency synchronous step-down converter, which uses VLIO as input voltage. The core voltage regulator can provide up to 600mA.

About the Development Board

C H A P T E R 2

The NS9210 Processor Module Development board supports the NS9210 Processor Module. This chapter describes the components of the development board and explains how to configure the board for your requirements.

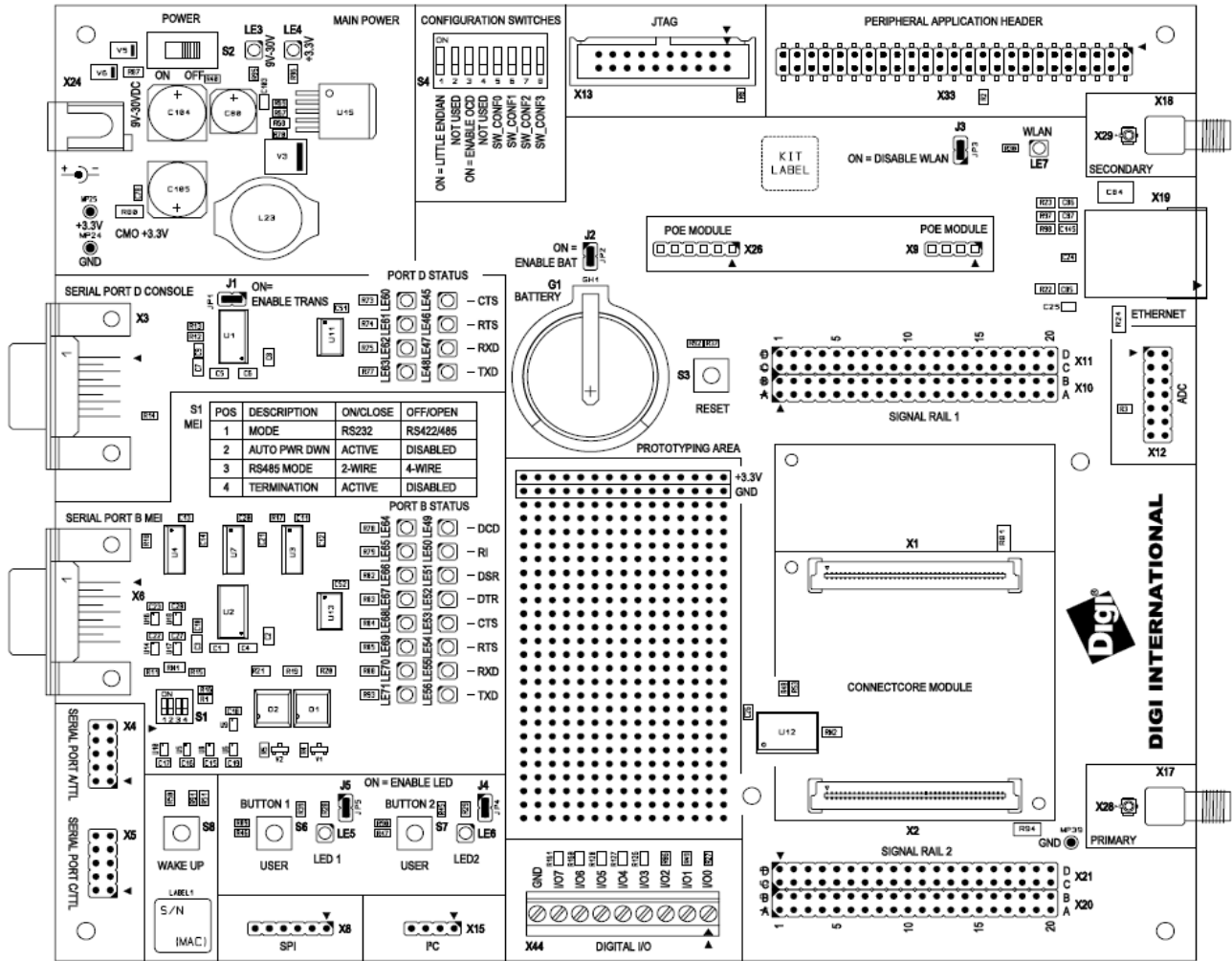
The development board has two 4x20 pin connectors that are 1:1 copies of the module pins.

What's on the development board?

- RJ-45 Ethernet connector
 - 2 x RP-SMA antenna connectors (reserved for future use)
 - Four serial interface connectors:
 - 1 x UART B MEI (RS232/RS4xx) with status LEDs on SUB-D 9-pin connector (X6)
 - 1 x UART D RS232 with status LEDs, on SUB-D 9-pin connector (X3)
 - 1 x UART C with TTL levels shared with HDLC signals on 10-pin header (X5)
 - 1 x UART A with TTL levels shared with SPI signals on 10-pin header (X4)
 - ADC, SPI, and I2C headers
 - JTAG connector
 - Peripheral application header
 - Including access to 16-bit data/10-bit address bus signals
 - Headers with 1:1 copies of the module pins (X1/X2)
 - Two user pushbuttons, two user LEDs, wake-up button
 - Eight-position configuration dip switches
- Four each for hardware/software configuration
- GPIO screw-flange connector

- +9/30VDC power supply
- Current measurement option
- Development board + Module, and module alone
- 3.3V coincell battery with socket
- PoE connectors for optional application kit (IEEE 802.3af)
- Prototyping area (15 x 28 holes) with +3.3V and GND connections

The development board



User interface

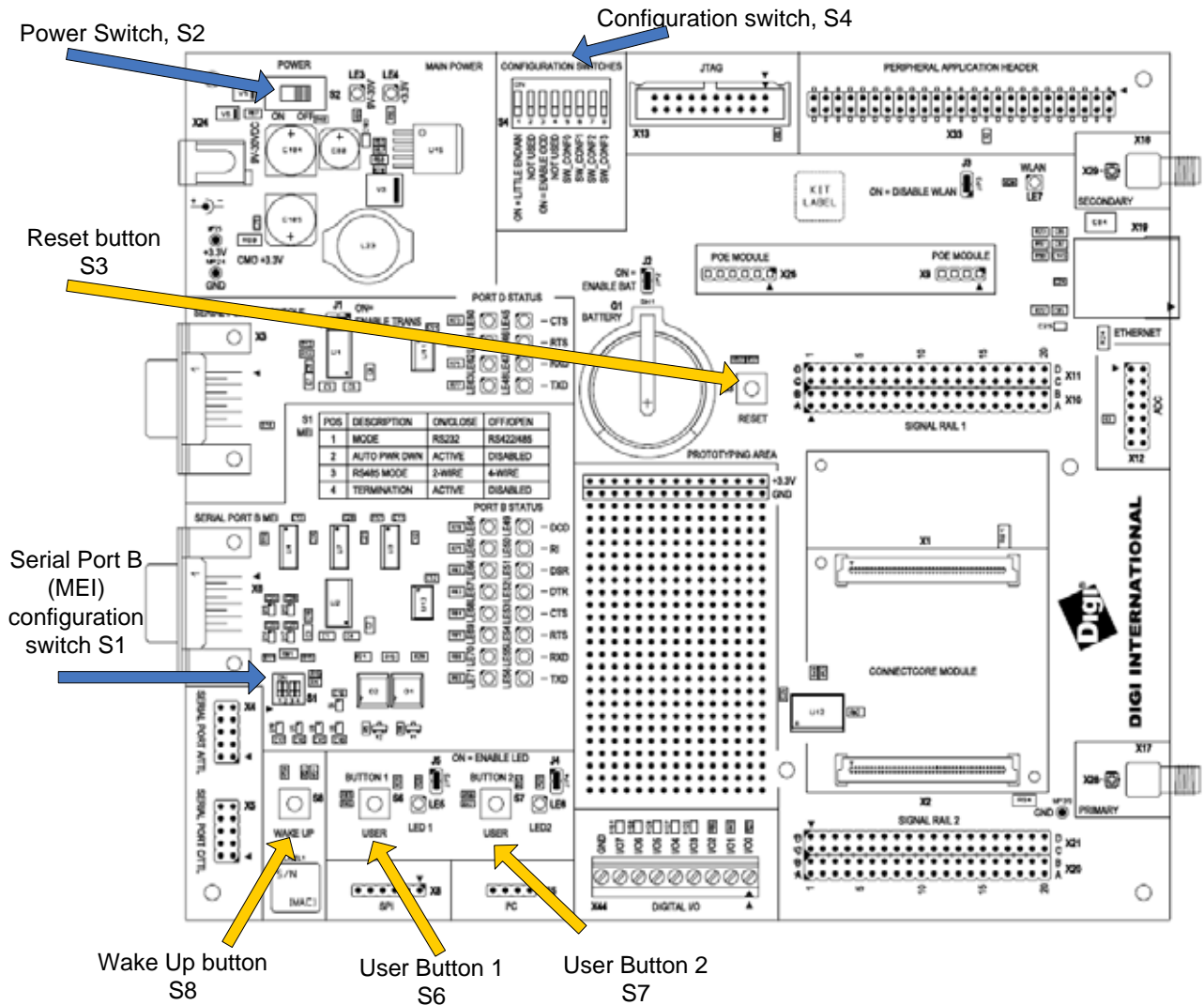
The NS9210 Processor Module Development board implements two user buttons and two user LEDs in addition to those provided on the module.

The user LEDs on the development board can be enabled or disabled by correctly setting jumper J5&6.

The table below shows which NS9215 GPIO is available for implementing the user interface.

Signal name	GPIO used	Comments
USER_BUTTON1	GPIO81	10k pull-up to +3.3V on the development board
USER_LED1#	GPIO82	
USER_BUTTON2	GPIO84	10k pull-up to +3.3V on the development board
USER_LED2#	GPIO85	

Switches and pushbuttons



Reset control, S3

The reset pushbutton, S3, resets the module. On the module, RSTOUT# and PWRGOOD are produced for peripherals. A pushbutton allows manual reset by connecting RSTIN# to ground. The reset controller is located on the NS9210 Processor Module.

Power switch, S2

The development board has an ON/OFF switch, S2. The power switch S2 can switch both 9V-30V input power supply and 12V coming out of the PoE module. However, if a power plug is connected in the DC power jack, the PoE module is disabled.

User pushbuttons, S6 and S7

Use the user pushbuttons to interact with the applications running on the NS9210 Processor Module. Use these module signals to implement the pushbuttons:

Signal name	Switch (pushbutton)	GPIO used
USER_PUSH_BUTTON_1	S6	GPIO81
USER_PUSH_BUTTON_2	S7	GPIO84

Legend for multi-pin switches

Switches 1 and 4 are multi-pin switches. In the description tables for these switches, the pin is designated as *S[switch number].[pin number]*. For example, pin 1 in switch 4 is specified as S4.1.

Module configuration switches, S4

Use S4 to configure the module:

Switch pin	Function
S4.1	On = Little endian Off = Big endian
S4.2	Not used
S4.3	On = ARM Debug Off = Boundary Scan
S4.4	Not used
S4.5 – S4.8	Not defined. Software configuration signals, which can be available for user specific configuration.

Wake-up button, S8

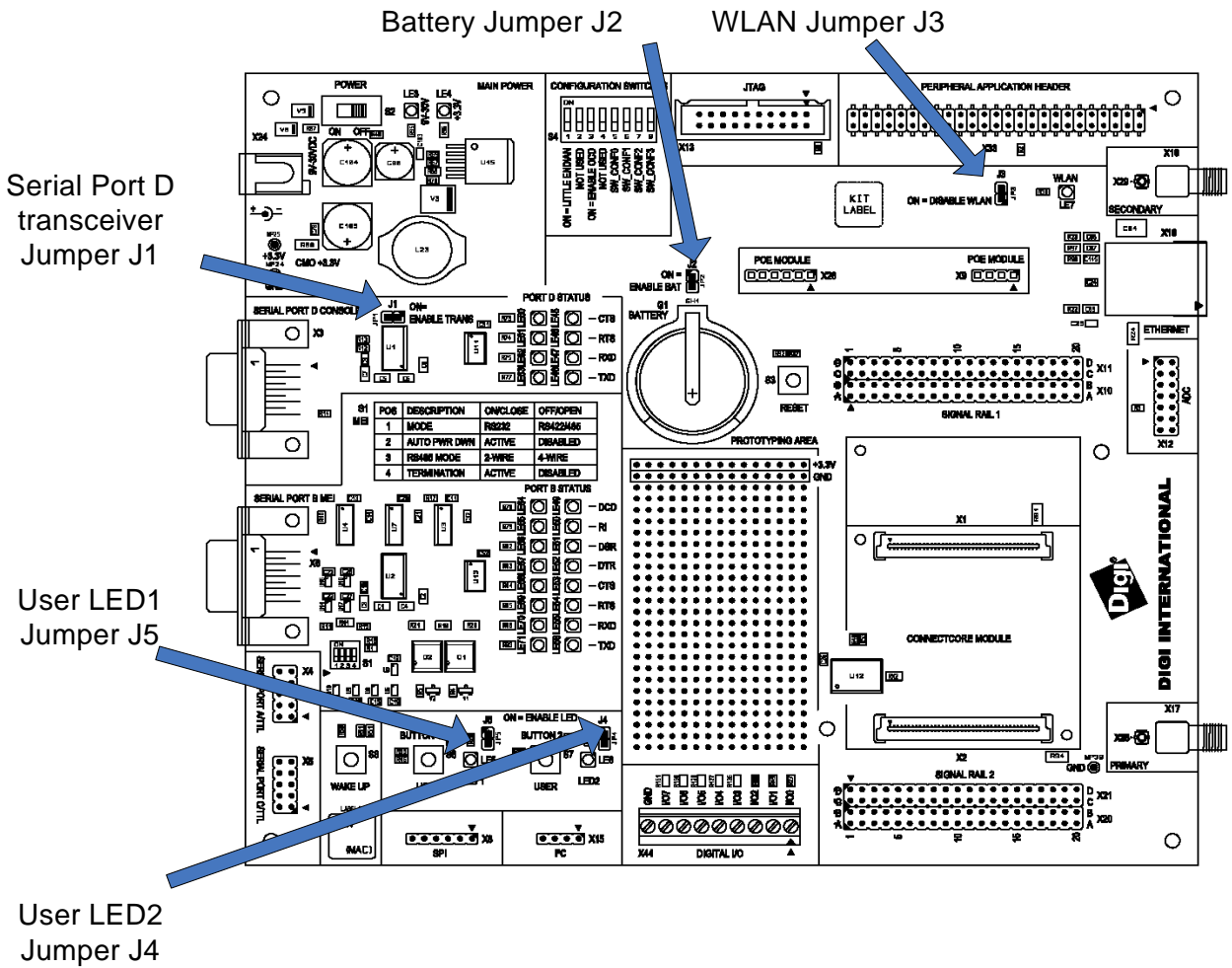
The wake-up pushbutton, S8, generates an external interrupt to the module's NS9215 processor using the EIRQ2 signal.

Serial Port B MEI configuration switches, S1

Use S1 to configure the line interface for serial port B MEI:

Switch pin	Function	Comments
S1.1	On = RS232 transceiver enabled RS422/RS485 transceivers disabled Off = RS232 transceiver disabled RS422/RS485 transceivers enabled	
S1.2	On = Auto Power Down enabled Off = Auto Power Down disabled	Auto Power Down is not supported on this board. This signal is only accessible to permit the user to completely disabled the MEI interface for using the signals for other purposes. To disable the MEI interface, go in RS232 mode (S1.1 = ON) and activate the Auto Power Down feature (S1.2 = ON) - be sure that no cable is connected to connector X3.
S1.3	On = 2-wire interface (RS422/RS485) Off = 4-wire interface (RS422)	
S1.4	On = Termination on Off = No termination	

Jumpers



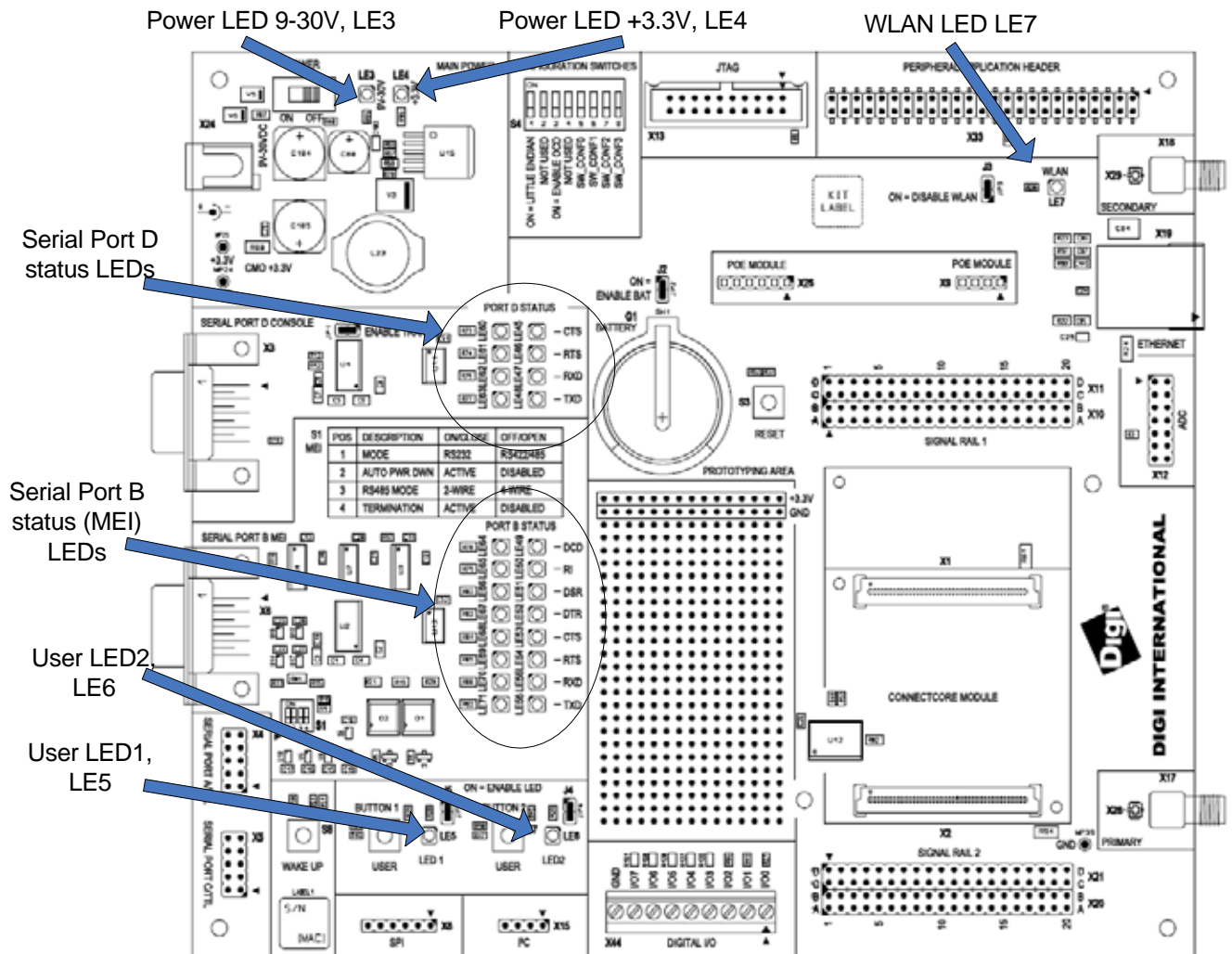
Jumper functions

Jumper	Name	If connection made	Default
J1	Enable transceiver	This jumper allows to disable the console RS232 transceiver.	Connection made = console active
J2	Battery enable	Supplies the real time clock with 3V from the battery (lithium coin cell battery, G1) even if the board is switched off. This is for keeping time in the RTC.	Connection not made = Backup battery disabled
J3	WLAN_DISABLE#	Reserved for future use. Disables the WiFi unit on the module.	Connection made = WLAN disabled
J4	USER_LED2#	Enables User LED2 (LE6) to show the status of this signal (lit if low).	Connection made = User LED2 enabled
J5	USER_LED1#	Enables User LED1 (LE5) to show the status of this signal (lit if low).	Connection made = User LED1 enabled

Battery and Battery Holder

Battery Holder	Battery
Coin-Cell Holder for CR2477 Battery, THT	Lithium coin cell, CR2477, 24mm, 950mAh
Keystone 1025-7	Panasonic CR2477
Ettinger 15.61.252	Renata CR2477N

LEDs



WLAN LED LE7 Reserved for future use.

Power LEDs, LE3 and LE4

The power LEDs are all red LEDs. These power supplies must be present and cannot be switched.

- LE3 ON indicates the +9VDC / +30VDC power is present.
- LE4 ON indicates the +3.3VDC power is present.

User LEDs, LE5 and LE6

The user LEDs are controlled through applications running on the NS9210 Processor Module, if J5 and J4 are set. Use these module signals to implement the LEDs:

Signal name	LED	GPIO used
USER_LED1#	LE5	GPIO82
USER_LED2#	LE6	GPIO85

Serial status LEDs

The development board has two sets of serial port LEDs – four for serial port D and eight for serial port B. The LEDs are connected to the TTL side of the RS232 or RS422/485 transceivers.

- Green means corresponding signal high.
- Red means corresponding signal low.
- The intensity and color of the LED will change when the voltage is switching.

Status LEDs Serial Port D LEDs

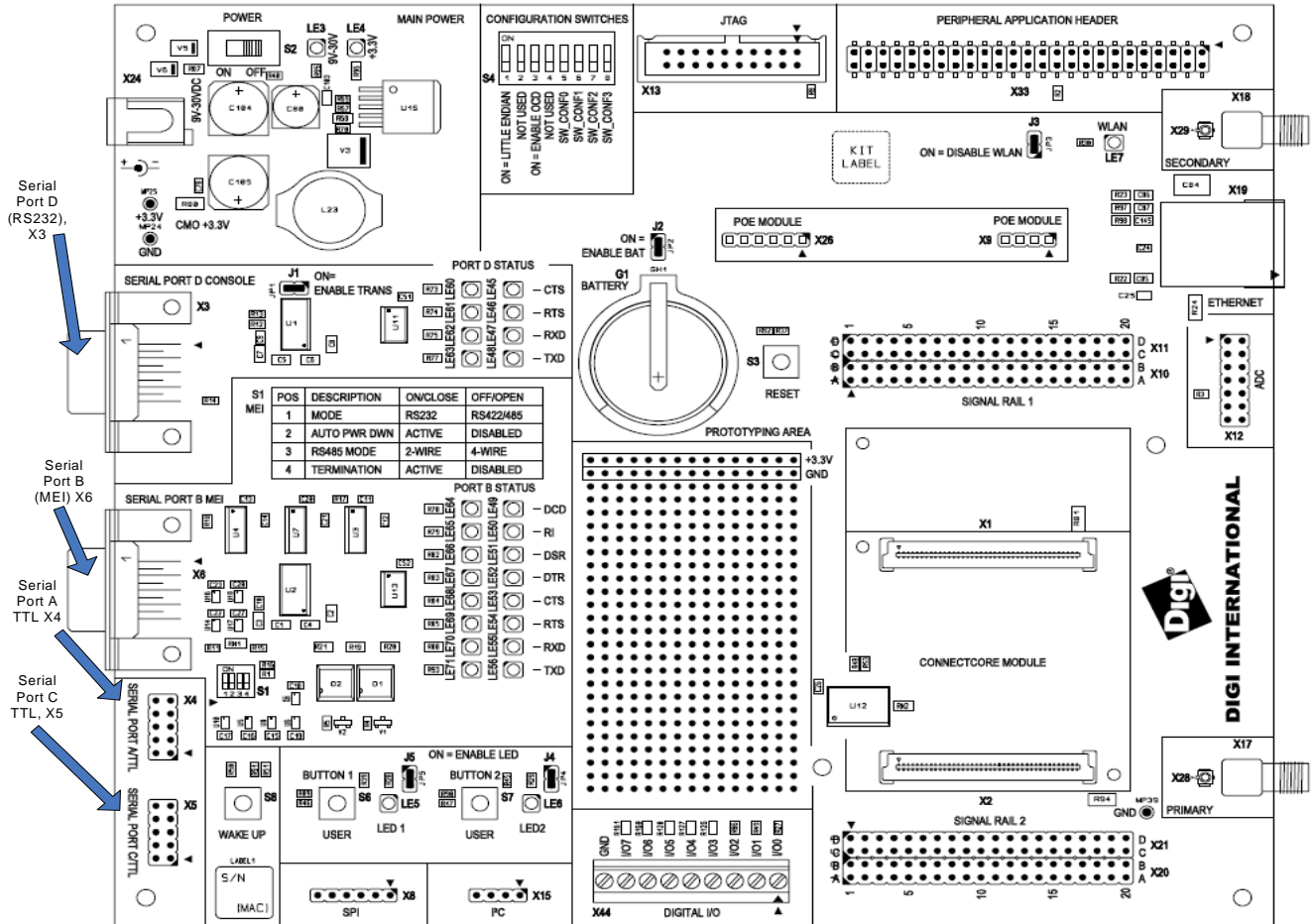
LED reference	Function
RED GREEN	
LE60 LE45	CTSD#/GPIO60
LE61 LE46	RTSD#/GPIO64
LE62 LE47	RXDD/GPIO62
LE63 LE48	TXDD/GPIO66

Status LEDs Serial Port B LEDs

LED reference	Function
RED GREEN	
LE64 LE49	DCDB#/GPIO51
LE65 LE50	RIB#/GPIO55
LE66 LE51	DSRB#/GPIO53
LE67 LE52	DTRB#/GPIO57
LE68 LE53	CTSB#/GPIO52
LE69 LE54	RTSB#/GPIO56
LE70 LE55	RXDB/GPIO54
LE71 LE56	TXDB/GPIO58

Serial UART ports

The development board supports the four serial ports available on the NS9210 Processor Module.



Serial port D, RS232

The serial (UART) port D connector, X3, is a DSUB9 male connector and is also used as the standard console. This asynchronous serial port is DTE and requires a null-modem cable to connect to a computer serial port.

The serial port D interface corresponds to NS9215 UART port D. The line driver is enabled or disabled using the jumper J1.

Serial port D pins are allocated as shown:

Pin	Function	Defaults to
1	DCD#	GPIO59
2	RXD	GPIO62
3	TXD	GPIO66
4	DTR#	GPIO65
5	GND	
6	DSR#	GPIO61
7	RTS#	GPIO64
8	CTS#	GPIO60
9	RIB#	GPIO63

By default, Serial D signals are configured to their respective GPIO signals. It is the responsibility of the driver to configure them properly.

Serial port A TTL interface

The serial (UART) port A interface is a TTL interface connected to a 2x5 pin, 0.1" connector, X4. The connector supports only TTL level.

The serial port A interface corresponds to NS9215 UART port A.

Serial port A pins are allocated as shown:

Pin	Function	Defaults to	Comment
1	DCDA#/SPI_EN#	GPIO0	Can be programmed as SPI enable to X4
2	DSRA#	GPIO2	
3	RXDA/SPI_RXD	GPIO3	Can be programmed as SPI receive data to X4
4	RTSA#/SPI_CLK	GPIO5	Can be programmed as SPI clock to X4
5	TXDA/SPI_TXD	GPIO7	Can be programmed as SPI transmit data to X4
6	CTSA#	GPIO1	
7	DTRA#	GPIO6	
8	RIA#/EIRQ2	GPIO4	This signal is default configured to support the wake-up button on the development board.
9	GND		
10	3.3V		

By default, Serial A signals are configured to their respective GPIO signals. It is the responsibility of the driver to configure them properly.

Serial Port A must not be connected if SPI or WakeUp functionality is used.

Serial port C TTL interface

The serial (UART) port C interface is a TTL interface connected to a 2x5 pin, 0.1" connector, X5. The connector supports only TTL level.

The serial port C interface corresponds to the NS9215 UART port C. The signals are shared with the HDLC interface.

Serial port C pins are allocated as shown:

Pin	Function	Defaults to
1	DCDC#/TXCLKC	GPIO8.
2	DSRC#	GPIO10.
3	RXDC#	GPIO11
4	RTSC#/RXCLKC	GPIO13
5	TXDC	GPIO15
6	CTSC#	GPIO9
7	DTRC#/TXCLKC	GPIO14
8	RIC#/RXCLKC/GPIO 12	RESET_DONE See note
9	GND	
10	3.3V	

Note: By using GPIO12 as RIC#, be sure to populate a series resistor on the baseboard. This is necessary to avoid conflict between the default configuration of the GPIO when booting (RESET_DONE / output) and the chosen configuration once booted (RIC# / input).

By default, Serial C signals are configured to their respective GPIO signals, except for GPIO12. It is the responsibility of the driver to configure them properly.



Serial port B, MEI interface

The serial (UART) port B connector, X6, is a DSUB9 male connector. This asynchronous serial port is DTE and requires a null-modem cable to connect to a computer serial port.

The serial port B MEI (Multiple Electrical Interface) interface corresponds to NS9215 UART port B. The line drivers are configured using switch S1.

Note that all pins on S1 contribute to the line driver settings for this port.

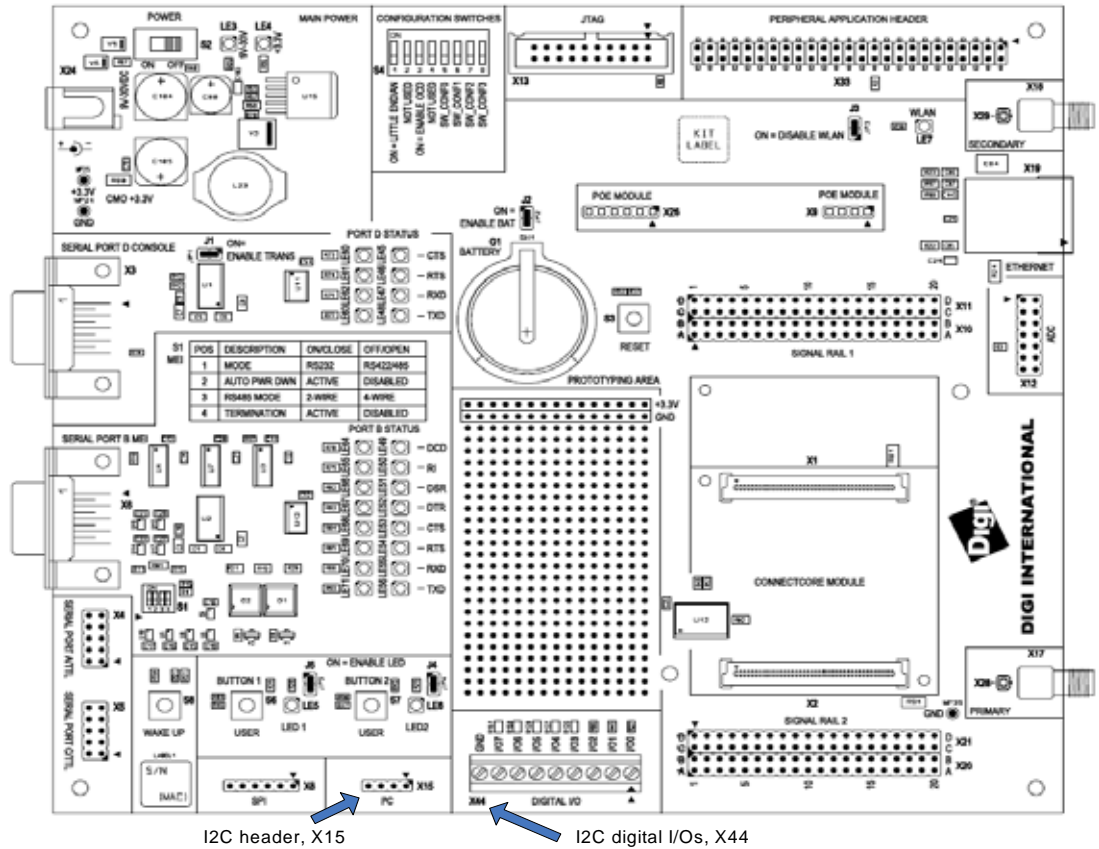
Serial port B pins are allocated as shown:

Pin	RS232 function	RS232 default	RS485 function	RS485 default
1	DCD#	GPIO51	CTS-	n/a
2	RXD	GPIO54	RX+	GPIO54
3	TXD	GPIO58	TX+	GPIO58
4	DTR#	GPIO57	RTS-	n/a
5	GND		GND	
6	DSR#	GPIO53	RX-	n/a
7	RTS#	GPIO56	RTS+	GPIO56
8	CTS#	GPIO52	CTS+	GPIO52
9	RI#	GPIO55	TX-	n/a

By default, Serial B signals are configured to their respective GPIO signals.

It is the responsibility of the driver to configure them properly.

I²C interface



I²C header

The I²C interface has only one device connected to the bus on the development board - an I/O expander (see next paragraph). Otherwise, additional I²C devices (like EEPROMs) can be connected to the module by using I²C header X15. The pinning of this header is provided below.

Pin	Signal
1	I2C_SDA/GPIO103
2	+3.3V
3	I2C_SCL/GPIO102
4	GND

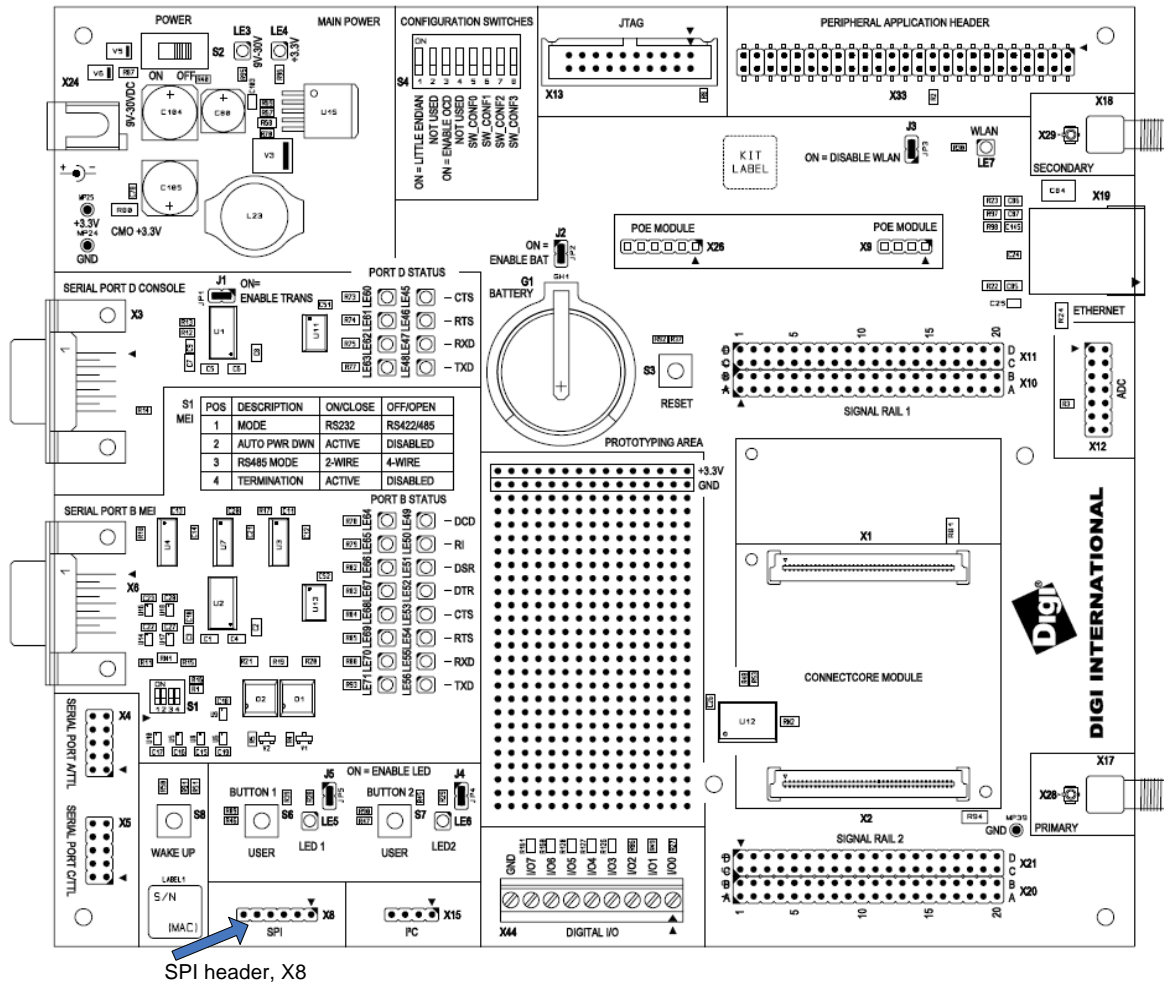
I²C digital I/O expansion

The development board provides a 3.81mm (1.50") green terminal block, X44, for additional digital I/Os. The I²C I/O port chip is on-chip ESD-protected, 5V tolerant, and provides an open drain interrupt output.

The I/O expander is a Philips PCA9554D at I²C address 0x20 / 0x21. The pins are allocated as shown:

Pin	Signal
1	IO_0
2	IO_1
3	IO_2
4	IO_3
5	IO_4
6	IO_5
7	IO_6
8	IO_7
9	GND

SPI interface



The development board provides access to the SPI interface on the module using the SPI connector, X8. The SPI interface on the development board is shared with UART_A (NS9215 port A). Because the module's SPI interface is shared with a UART interface, you cannot use both simultaneously.

Note: The default configuration of UART port A is to support GPIOs. To move from GPIO to UART or SPI, you need to configure the software properly.

Pin allocation

SPI connector pins are allocated as shown:

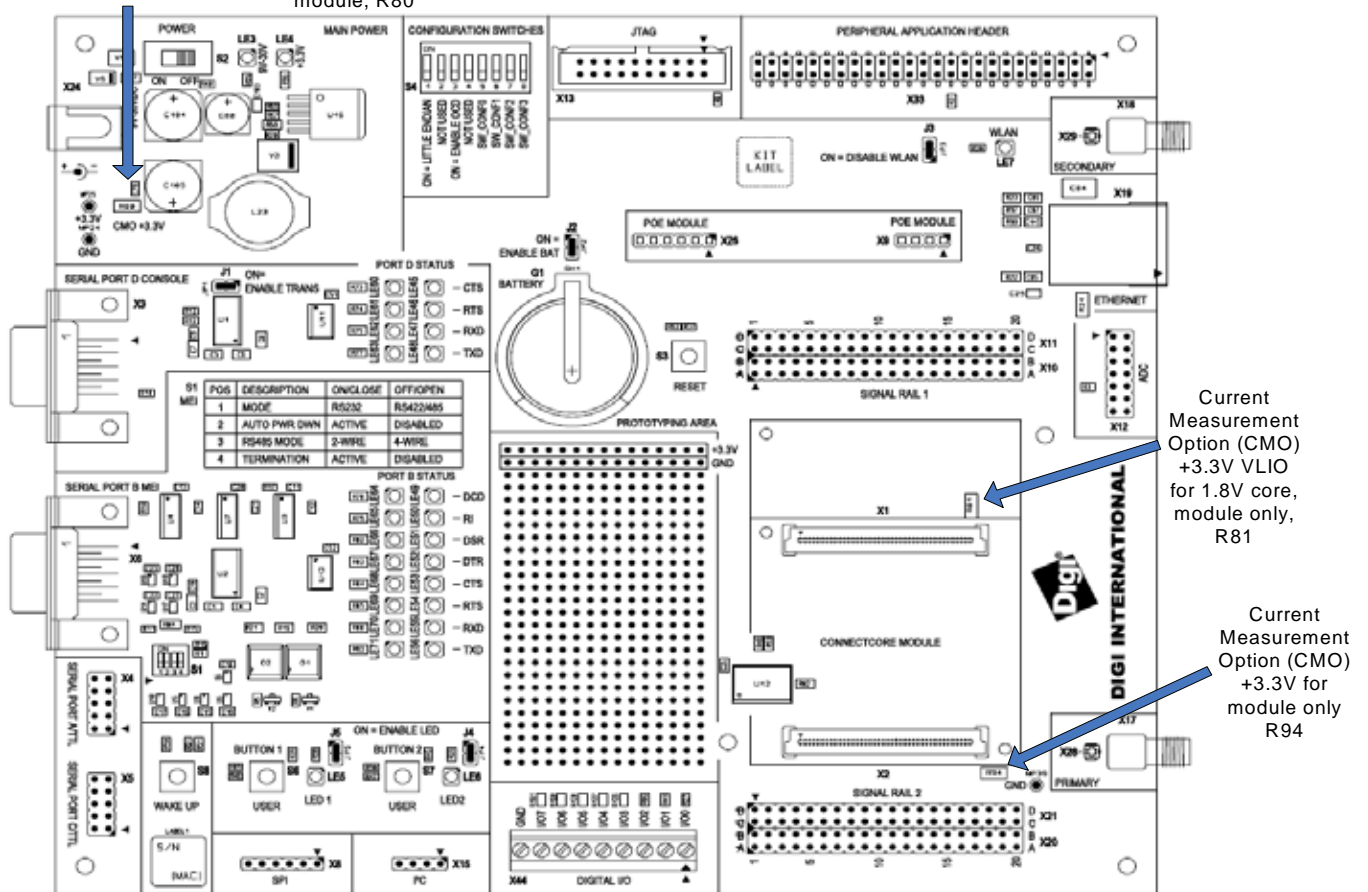
Pin	Signal
1	+3.3V
2	TXDA/SPI_TXD/GPIO7
3	RXDA/SPI_RXD/GPIO3
4	RTSA#/SPI_CLK/GPIO5
5	DCDA#/SPI_EN#/GPIO0
6	GND

Current Measurement Option

The Current Measurement Option uses 0.025R ohm series resistors to measure the current. The NS9210 Processor Module Development board allows to measure:

- the current used by the development board and module (through R80), and
- the current used by the internal NS9215 1.8V core generated from VLIO using a high-efficiency synchronous step-down converter (through R81)

Current Measurement Option (CMO) +3.3V development board and module, R80



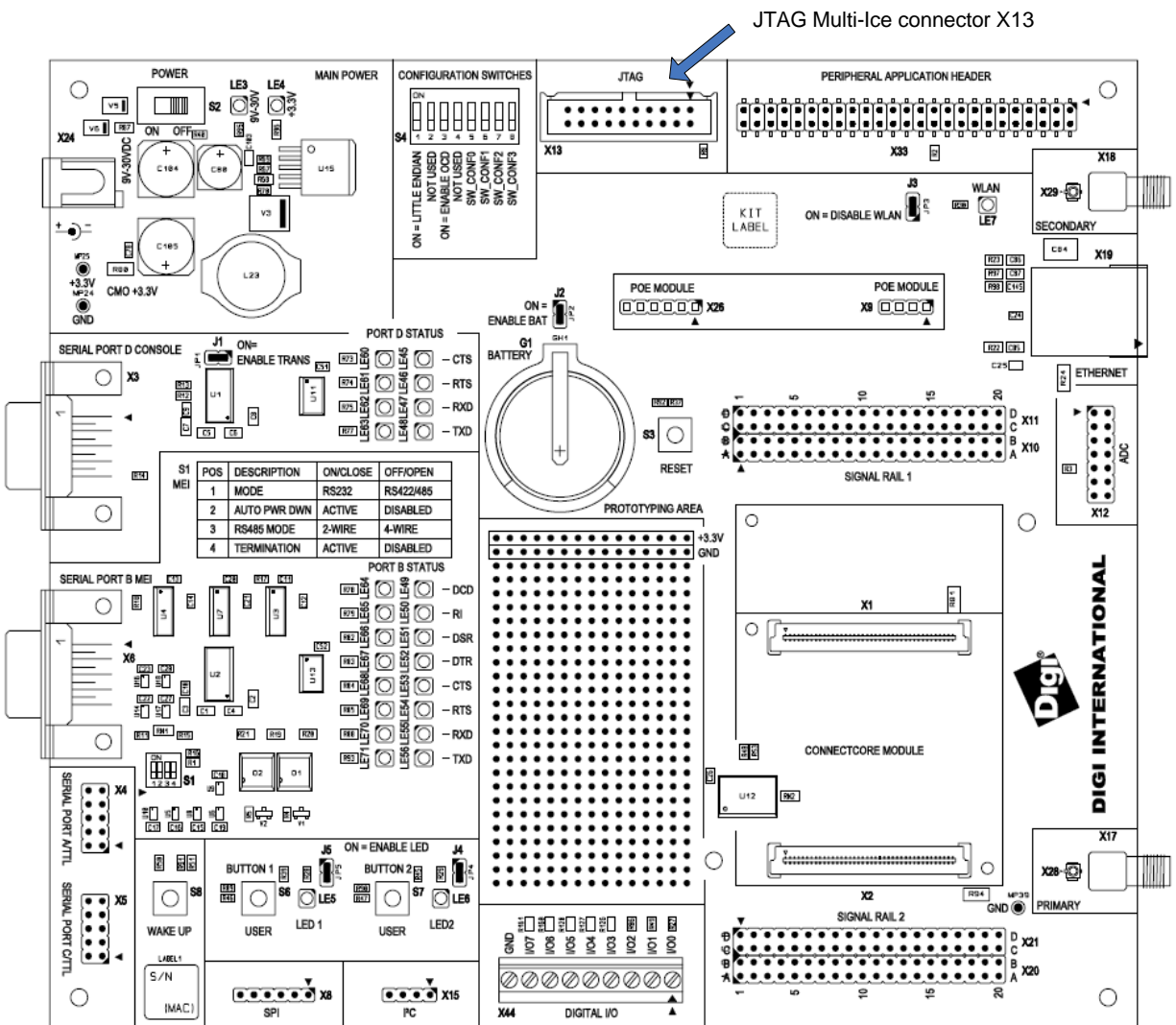
How the CMO works

To measure the load current used on different power supplies, measure DC voltage across the sense (CMO) resistor. The value of the resistor is $0.025R \pm 1\%$. Calculate the current using this equation: $I = U/R$

where

- I = current in Amps
- U = measured voltage in Volts
- $R = 0.025$ Ohms

JTAG interface



Standard JTAG ARM connector, X13

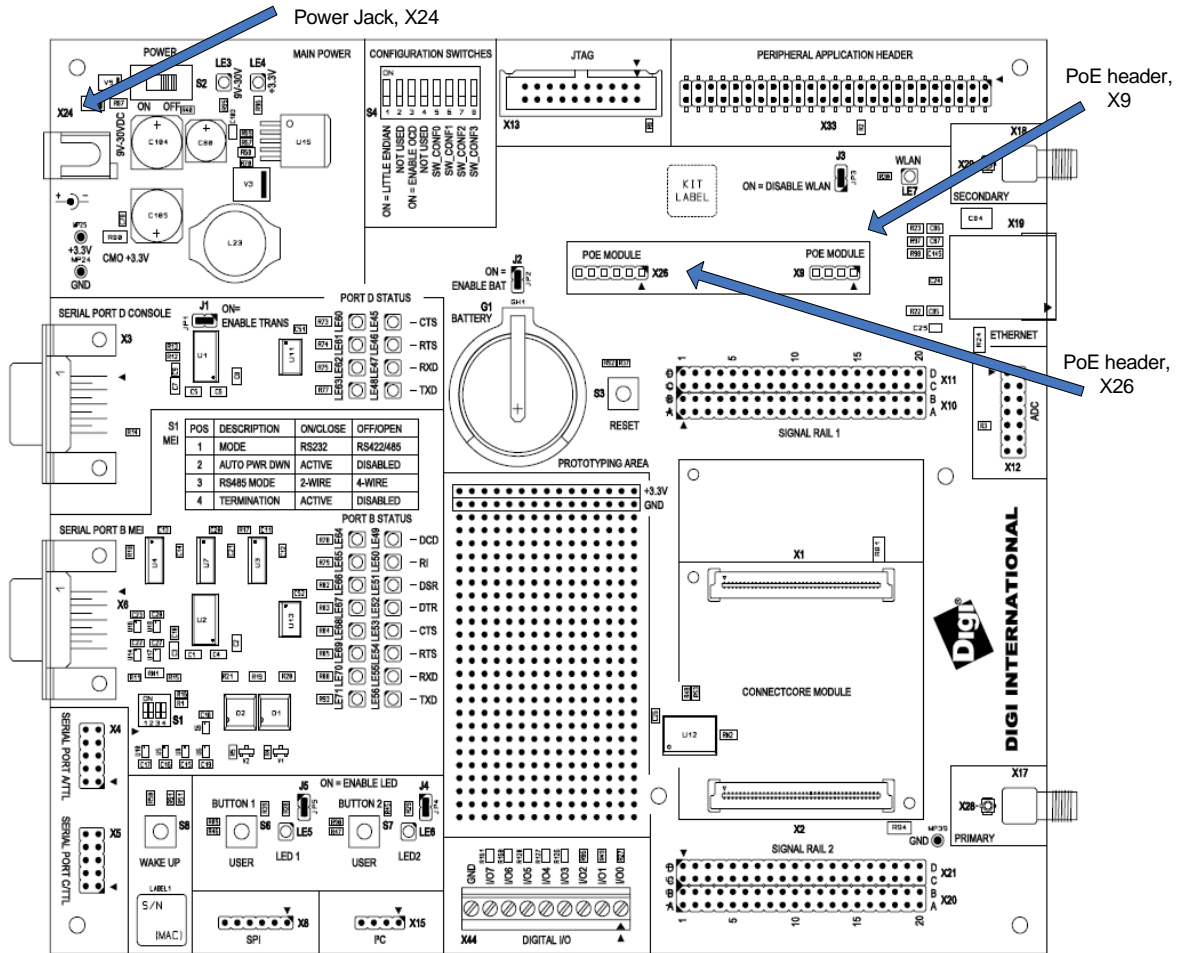
The standard JTAG ARM connector is a 20-pin header and can be used to connect development tools such as Digi's JTAG Link, ARM's Multi-ICE, Abatron BDI2000, and others.

Pin	Signal	Pin	Signal
1	+3.3V	2	+3.3V
3	TRST#	4	GND
5	TDI	6	GND
7	TMS	8	GND
9	TCK	10	GND
11	RTCK (optional)	12	GND
13	TDO	14	GND
15	SRESET#	16	GND
17	No connect	18	GND
19	No connect	20	GND

PoE module connectors - IEEE802.3af

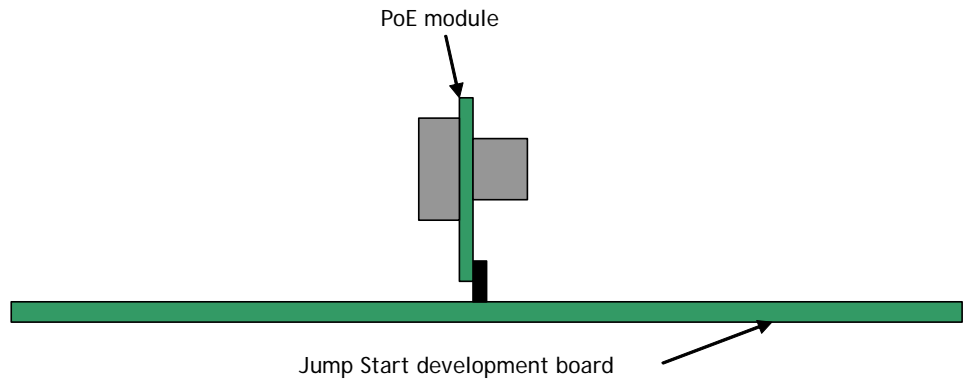
The development board has two PoE module connectors, X9 and X26. The PoE module is an optional accessory item that can be plugged on the development board through the two connectors:

- X9, input connector: Provides access to the PoE signals coming from the Ethernet interface.
- X26, output connector: Provides the output power supply from the PoE module.



The PoE module

Plug in the PoE module at a right angle to the development board, as shown in this drawing:



X9

This is how the PoE input connector pins are allocated:

Pin	Signal
1	POE_TX_CT
2	POE_RX_CT
3	POE_RJ45_4/5
4	POE_RJ45_7/8

X26

This is how the PoE output connector pins are allocated:

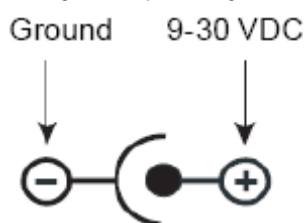
Pin	Signal
1	+12V_PoE
2	+12V_PoE
3	GND
4	GND
5	PoE_GND
6	PoE_GND

POE_GND

The development board provides access to POE_GND allowing it to be turned off when power is provided through Power Jack X26.4 and X26.5.

Power Jack, X24

The power jack is a barrel connector with 9-30VDC operating range. The power jack is labeled X24 on the development board. This figure schematically represents the power jack's polarity.

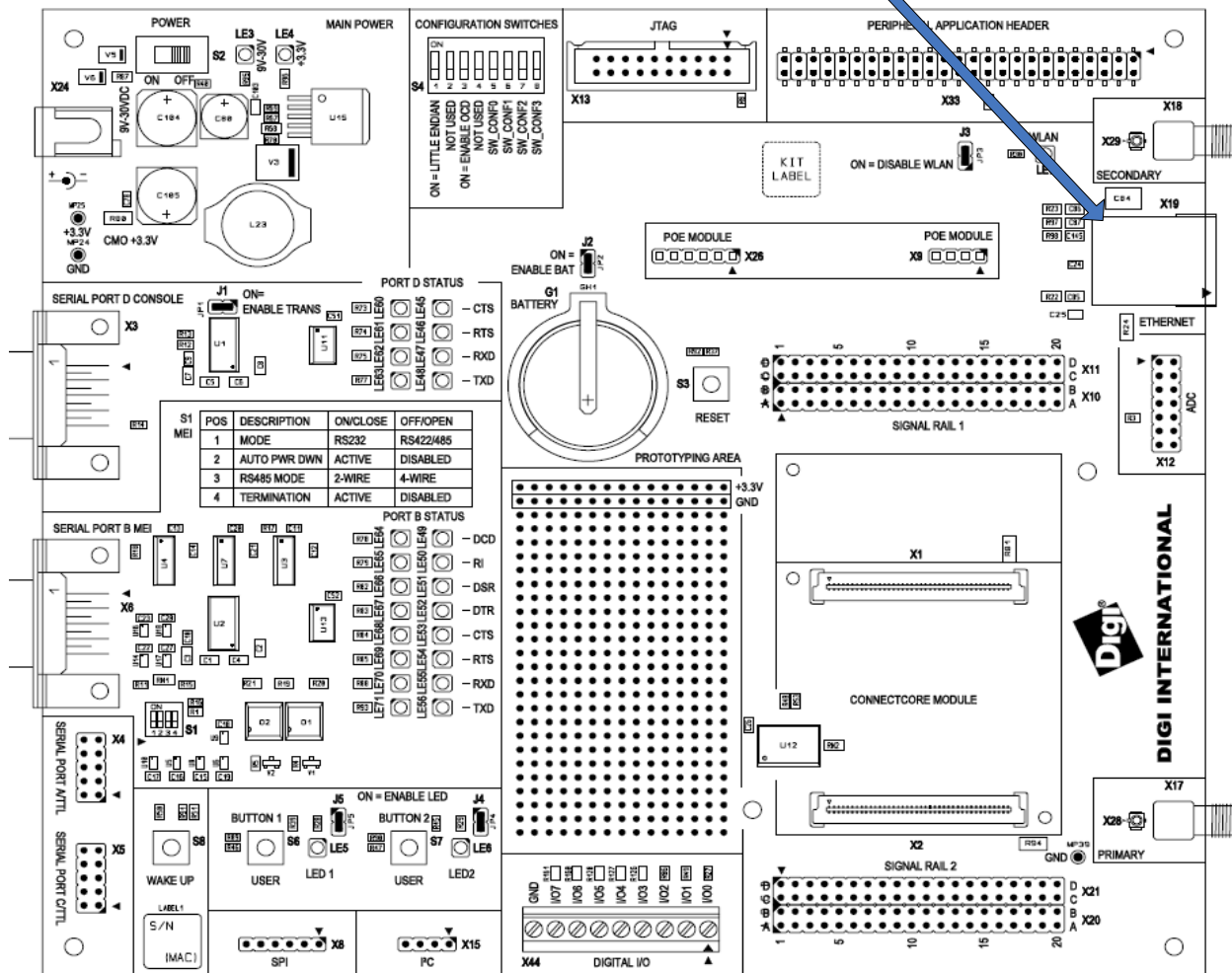


Ethernet interface

The module provides the 10/100 Ethernet PHY chip. The development board provides the 1:1 transformer and Ethernet connector.

The Ethernet connector is an 8-wire RJ-45 jack, labeled X19, on the development board. The connector has eight interface pins, as well as two integrated LEDs that provide link status and network activity information.

Ethernet RJ-45, X19



RJ-45 pin allocation, X19

RJ-45 connector pins are configured as shown:

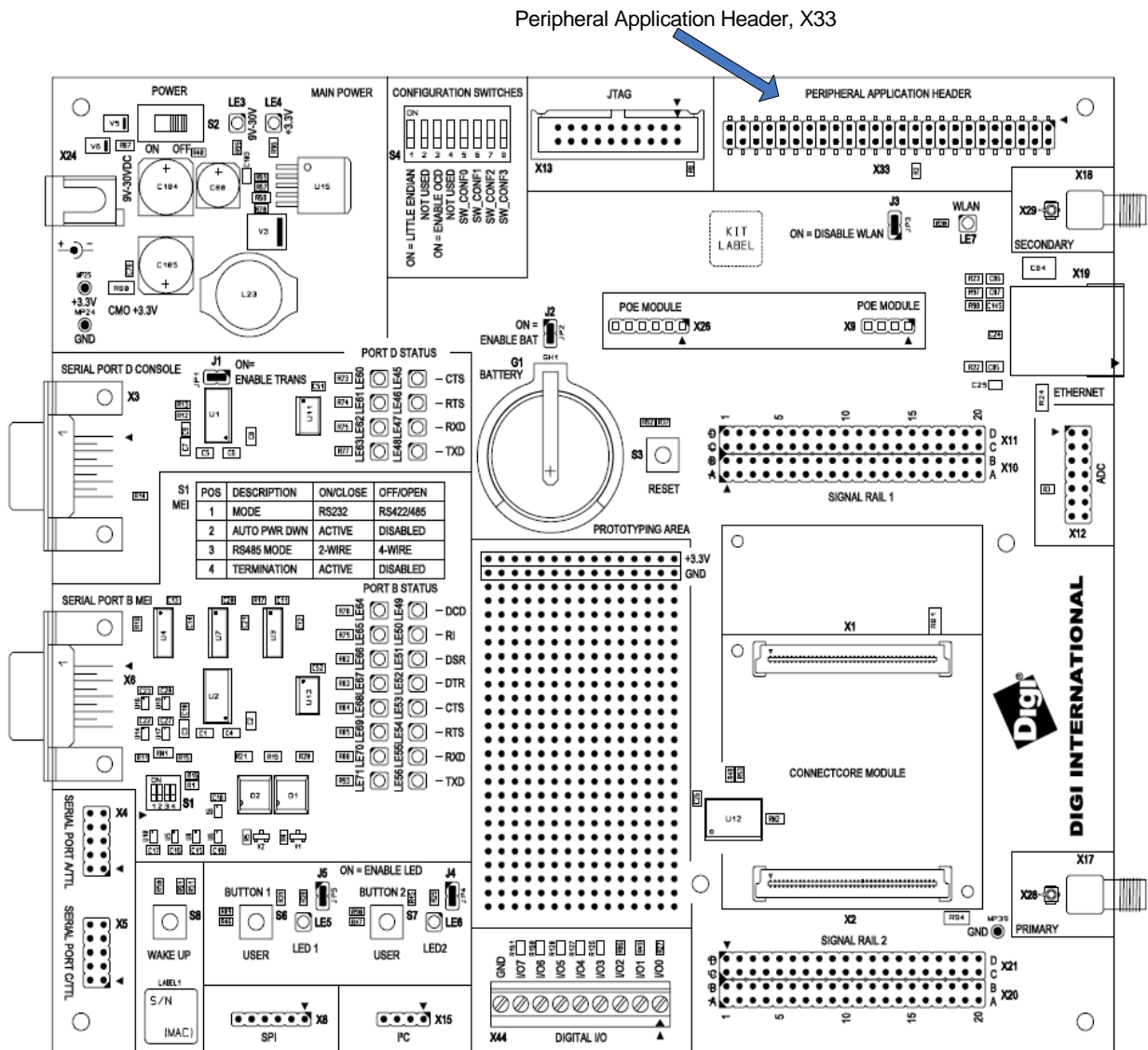
Pin	Signal	802.3af End-Span (mode A)	802.3af Mid-Span (Mode B)	Description
1	TXD+	Negative V_{Port}		Transmit data +
2	TXD-	Negative V_{Port}		Transmit data -
3	RXD+	Positive V_{Port}		Receive data +
4	EPWR+		Positive V_{Port}	Power from switch +
5	EPWR+		Positive V_{Port}	Power from switch +
6	RXD-	Positive V_{Port}		Receive data -
7	EPWR+		Negative V_{Port}	Power from switch -
8	EPWR+		Negative V_{Port}	Power from switch -

LEDs

The RJ-45 connector has two LEDs located near the outer lower corners of the connector. These LEDs are not programmable.

LED	Description
Yellow	Network activity (speed): Flashing when network traffic detected; Off when no network traffic detected.
Green	Network link: On indicates an active network link; Off indicates that no network link is present.

Peripheral (expansion) headers





The development board provides one, 2x25-pin, 0.10" (2.54mm) pitch header for supporting application-specific daughter cards/expansion boards:

- **X33, Peripheral application header.** Provides access to an 16-bit data bus, 10-bit address bus, and control signals (such as CE#, IRQ#, WE#), as well as I²C and power (+3.3V). Using these signals, you can connect Digi-specific extension modules or your own daughter card to the module's address/data bus.

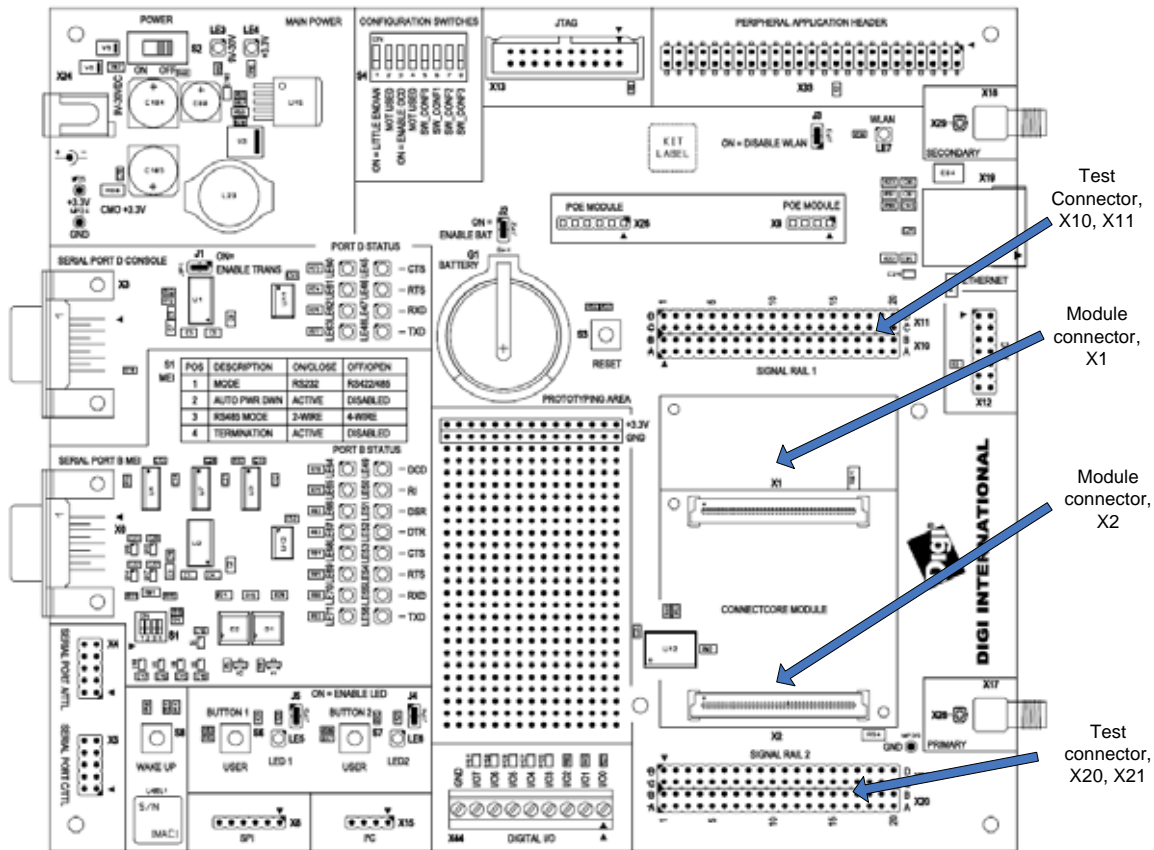
Peripheral application header, X33

Peripheral application pins are allocated as shown:

Pin	Signal	Pin	Signal
1	GND	2	BDO
3	BD1	4	BD2
5	BD3	6	GND
7	BD4	8	BD5
9	BD6	10	BD7
11	GND	12	BD8
13	BD9	14	BD10
15	BD11	16	GND
17	BD12	18	BD13
19	BD14	20	BD15
21	GND	22	* 8-bit / 16-bit# GND selects 16-bit data bus
23	GND	24	+3.3V
25	+3.3V	26	BA0
27	BA1	28	BA2
29	BA3	30	GND
31	BA4	32	BA5
33	BA6	34	BA7
35	GND	36	BA8
37	BA9	38	GND
39	EXT_CS0#	40	I2C_SDA/GPIO103
41	EXT_WE#	42	EXT_OE#
43	I2C_SCL/GPIO102	44	EIRQ3/GPIO101
45	+3.3V	46	+3.3V
47	GPIO86	48	GPIO87
49	EXT_CLK	50	GND

Module and test connectors

The NS9210 Processor Module plugs into the module connectors X1 and X2 on the development board.



Module connectors

See "Module pinout" on page 12 for related information.

Test connectors

The development board provides two 4x20 pin test connectors, labeled X10/X11 and X20/X21. These connectors are 1:1 copies of the module pins and are used for measurement or test purposes.

- X10 and X11 correspond to module connector X1.
- X20 and X21 correspond to module connector X2.

X10 pinout

X10 pin	Signal	X10 pin	Signal
A1	GND	B1	GND
A2	RSTOUT#	B2	TCK
A3	TDO	B3	TRST#
A4	LITTLE#/BIG_ENDIAN	B4	WLAN_DISABLE#
A5	SW_CONF2	B5	SW_CONF3
A6	BD0	B6	BD1
A7	BD4	B7	BD5
A8	BD8	B8	BD9
A9	BD12	B9	BD13
A10	GND	B10	BA0
A11	BA3	B11	BA4
A12	BA7	B12	BA8
A13	BA11	B13	BA12
A14	BA15	B14	BA16
A15	EXT_WE#	B15	EXT_CS0#
A16	BE3#	B16	EXT_WAIT#
A17	(ETH_TPIN) NC	B17	NC (ETH_ACTIVITY#)
A18	(ETH_TPON) NC	B18	NC (ETH_TPOP)
A19	Reserved*	B19	Reserved*
A20	Reserved*	B20	VBAT

*USB signals are reserved for future use.

X11 pinout

X11 pin	Signal	X11 pin	Signal
C1	RSTIN#	D1	SRESET#
C2	TMS	D2	TDI
C3	RTCK	D3	OCD_EN#
C4	SW_CONF0	D4	SW_CONF1
C5	(WLAN_LED#) Reserved	D5	GND
C6	BD2	D6	BD3
C7	BD6	D7	BD7
C8	BD10	D8	BD11
C9	BD14	D9	BD15

X11 pin	Signal	X11 pin	Signal
C10	BA1	D10	BA2
C11	BA5	D11	BA6
C12	BA9	D12	BA10
C13	BA13	D13	BA14
C14	GND	D14	EXT_OE#
C15	EXT_CS2#	D15	BE2#
C16	EXT_CLK	D16	GND
C17	(ETH_TPIP) NC	D17	NC (ETH_LINK#)
C18	GND	D18	Reserved*
C19	Reserved*	D19	Reserved*
C20	3.3V	D20	GND

*USB signals are reserved for future use.

X20 pinout

X20 pin	Signal	X20 pin	Signal
A1	GND	B1	GND
A2	DSRA#/GPIO2	B2	RXDA/SPI_RXD/GPIO3
A3	DTRA#/GPIO6	B3	TXDA/SPI_TXD/GPIO7
A4	DSRC#/GPIO10	B4	RXDC/GPIO11
A5	DTRC#/TXCLKC/GPIO14	B5	TXDC/GPIO15
A6	DSRB#/GPIO53	B6	RXDB/GPIO54
A7	DTRB#/GPIO57	B7	TXDB/GPIO58
A8	DSRD#/GPIO61	B8	RXDD/GPIO62
A9	DTRD#/GPIO65	B9	TXDD/GPIO66
A10	GPIO69	B10	GPIO70
A11	GPIO73	B11	GPIO74
A12	GPIO77	B12	GPIO78
A13	USER_BUTTON1#/GPIO81	B13	USER_LED1#/GPIO82
A14	USER_LED2#/GPIO85	B14	GPIO86
A15	GPIO94	B15	GPIO95
A16	CAN1_RXD/GPIO98	B16	CAN1_TXD/GPIO99
A17	I2C_SCL/GPIO102	B17	I2C_SDA/GPIO103
A18	ADC_IN2	B18	ADC_IN3

X20 pin	Signal	X20 pin	Signal
A19	ADC_IN6	B19	ADC_IN7
A20	+3.3V	B20	+3.3V

X21 pinout

X21 pin	Signal	X21 pin	Signal
C1	DCDA#/SPI_EN/GPIO0	D1	CTSA#/GPIO1
C2	RIA#/EIRO2/GPIO4	D2	RTSA#/SPI_CLK/GPIO5
C3	DCDC#/TXCLKC/GPIO8	D3	CTSC#/GPIO9
C4	RIC#/RXCLKC/GPIO12	D4	RTSC#/RCLKC/GPIO13
C5	DCDB#/GPIO51	D5	CTSB#/GPIO52
C6	RIB#/GPIO55	D6	RTSB#/GPIO56
C7	DCDD#/GPIO59	D7	CTSD#/GPIO60
C8	RID#/GPIO63	D8	RTSD#/GPIO64
C9	GPIO67	D9	GPIO68
C10	GPIO71	D10	GPIO72
C11	GPIO75	D11	GPIO76
C12	GPIO79	D12	GPIO80
C13	GPIO83	D13	USER_BUTTON2#/GPIO84
C14	GPIO87	D14	GPIO93
C15	CAN0_RXD/GPIO96	D15	CAN0_TXD/GPIO97
C16	GPIO100	D16	EIR03#/GPIO101
C17	ADC_IN0	D17	ADC_IN1
C18	ADC_IN4	D18	ADC_IN5
C19	AGND_ADC	D19	VREF_ADC
C20	GND	D20	GND

Appendix A: Specifications

This appendix provides NS9210 Processor Module and electrical specifications, as well as module and development board mechanical specifications.

Environmental specifications

The module board assembly meets all functional requirements when operating in this environment:

- Operating temperature: -40°C to +85°C
- Storage temperature: -40°C to +125°C
- Relative humidity: 5% to 95%, non-condensing
- Altitude: 0 to 12,000 feet

Mechanical specifications

The module size is 50 x 50mm.

Two board-to-board connectors are used on the module. The distance between the module and the base board depends on the counterpart on the base board. The minimum distance is 5mm.

The height of the parts mounted on the bottom side of the module should not exceed 2.5mm. The height of the parts mounted on the top side of the module should not exceed 4.1mm.

Safety statements

To avoid contact with electrical current:

- Never install electrical wiring during an electrical storm.

- Use a screwdriver and other tools with insulated handles.
- Wear safety glasses or goggles.
- Installation of inside wiring may bring you close to electrical wire, conduit, terminals and other electrical facilities. Extreme caution must be used to avoid electrical shock from such facilities. Avoid contact with all such facilities.
- Protectors and grounding wire placed by the service provider must not be connected to, removed, or modified by the customer.
- Do not touch or move the antenna(s) while the unit is transmitting or receiving.
- Do not hold any component containing a radio such that the antenna is very close to or touching any exposed parts of the body, especially the face or eyes, while transmitting.
- Do not operate a portable transmitter near unshielded blasting caps or in an explosive environment unless it is a type especially qualified for such use.
- Any *external* communications wiring you may install needs to be constructed to all relevant electrical codes. In the United States, this is the National Electrical Code Article 800. Contact a licensed electrician for details.

Power requirements

Parameter	Limits		
Input voltage (Vcc)	3.3V±5% (3.00V to 3.60V)		
Input current	554mA max		
Input low voltage	0.0V	<V _{IL}	<0.3*Vcc
Input high voltage	0.7*Vcc	<V _{IH}	<Vcc
Output low voltage	0.0V	<V _{OL}	<0.4V
Output high voltage	Vcc-0.4V	<V _{OH}	<Vcc

Typical module current / power measurements

The following illustrates typical power consumption when all clocks are active and the ethernet is connected to a 100Mb network.

	VLIO ¹	+3.3V ²	Total Power
With FIMs (DRPIC) enabled ^{3,4}	1.27 (384mA @ 3.3V)	.561W (170mA @ 3.3V)	1.83W
With FIMs (DRPIC) disabled ^{3,4}	.904W (274mA @ 3.3V)	.561W (170mA @ 3.3V)	1.47W

¹ VLIO is supplying the core voltage regulator. This value is reached when all clocks are on. This typical measurement was made with VLIO set to 3.3V. VLIO can vary between 2.5V to 5.0V.

² This value is reached when Ethernet is activated. This typical measurement was made with +3.3V set to 3.3V. +3.3V can vary between 3.1V to 3.6V.

³ FIM is the Flexible Interface Module.

⁴ DRPIC is a High performance 8-bit RISC Microcontroller.

Typical power save module / JumpStart board current / power consumption measurements

The following table illustrates typical power consumption using various NS9215 power management mechanisms. These measurements were taken with all NS9215 I/O clocks disabled except UART B, UART D, Ethernet MAC, I/O Hub, and the Memory Clock0 and the ethernet connected to a 100Mb network, using a standard module plugged into a JumpStart Kit board, with nominal voltage applied:

	Module and Dev Board ¹	Module only ²
Normal operational mode ³	1.63W (496mA)	1.45W (443mA)
Full clock scaling mode ⁴	.879W (267mA)	.683W (208mA)
Sleep mode ⁵	.346W (105mA)	.151W (46mA)

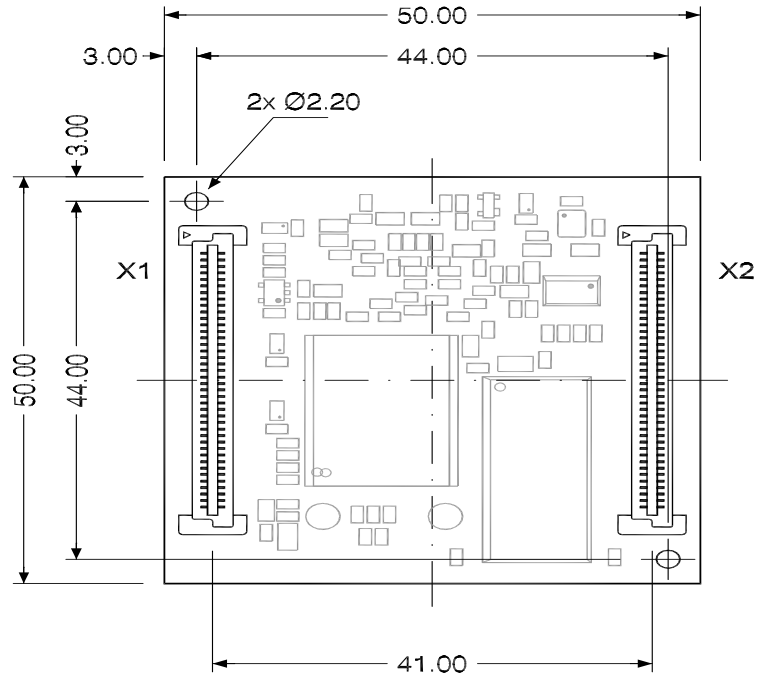
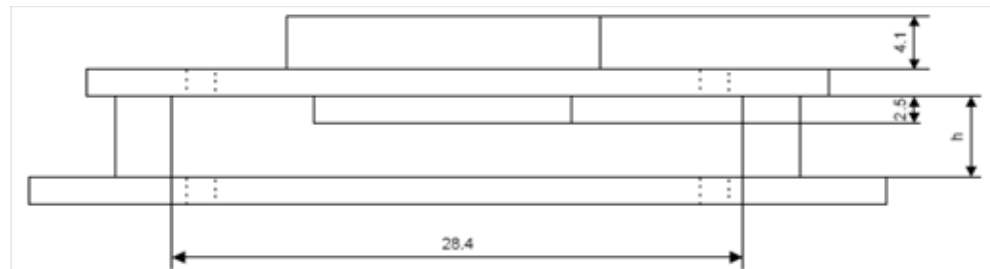
¹ This measurement was taken from the R80 current sense resistor (0.025 ohm) on the JumpStart Kit development board.

² This measurement represents only the current of the VLIO and +3.3V inputs to the module, measured from the two current sense resistors R81 and R94 (0.025 ohm) located on the JumpStart Kit development board.

³ This is the default power consumption mode when entering applicationStart(), as measured with the napsave sample application. The value of the NS9215 Clock Configuration register (A090017C) is 02012015 hexadecimal.

⁴ This measurement was produced by selecting the "Clock Scale" menu option in the napsave sample application.

⁵ This measurement was produced by selecting the "Deep Sleep/Wakeup with an External IRQ" menu option in the napsave sample application.

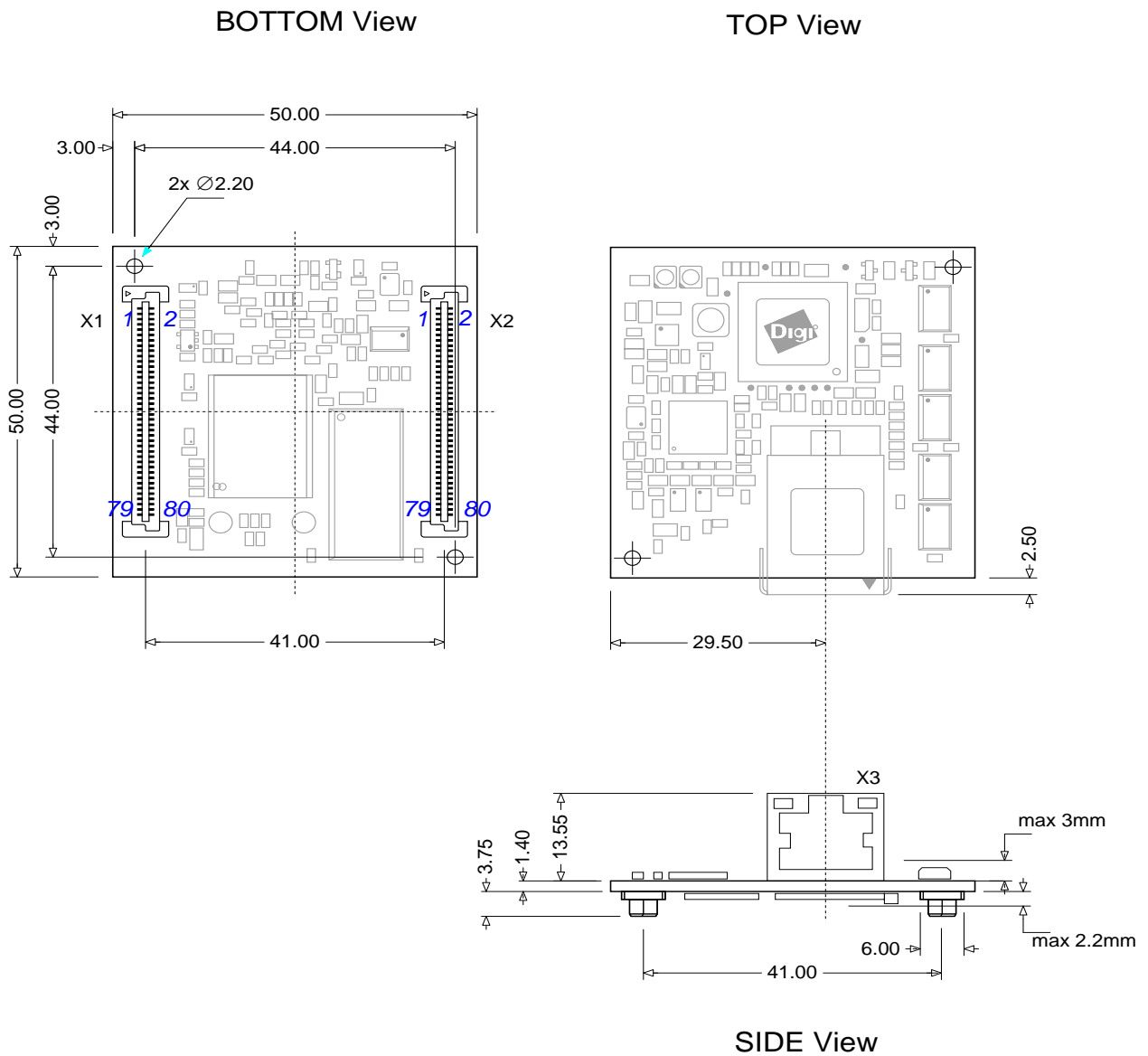
Module, top view**Note:** Measurements are in millimeters.**Module, side view****Note:** Measurements are in millimeters.

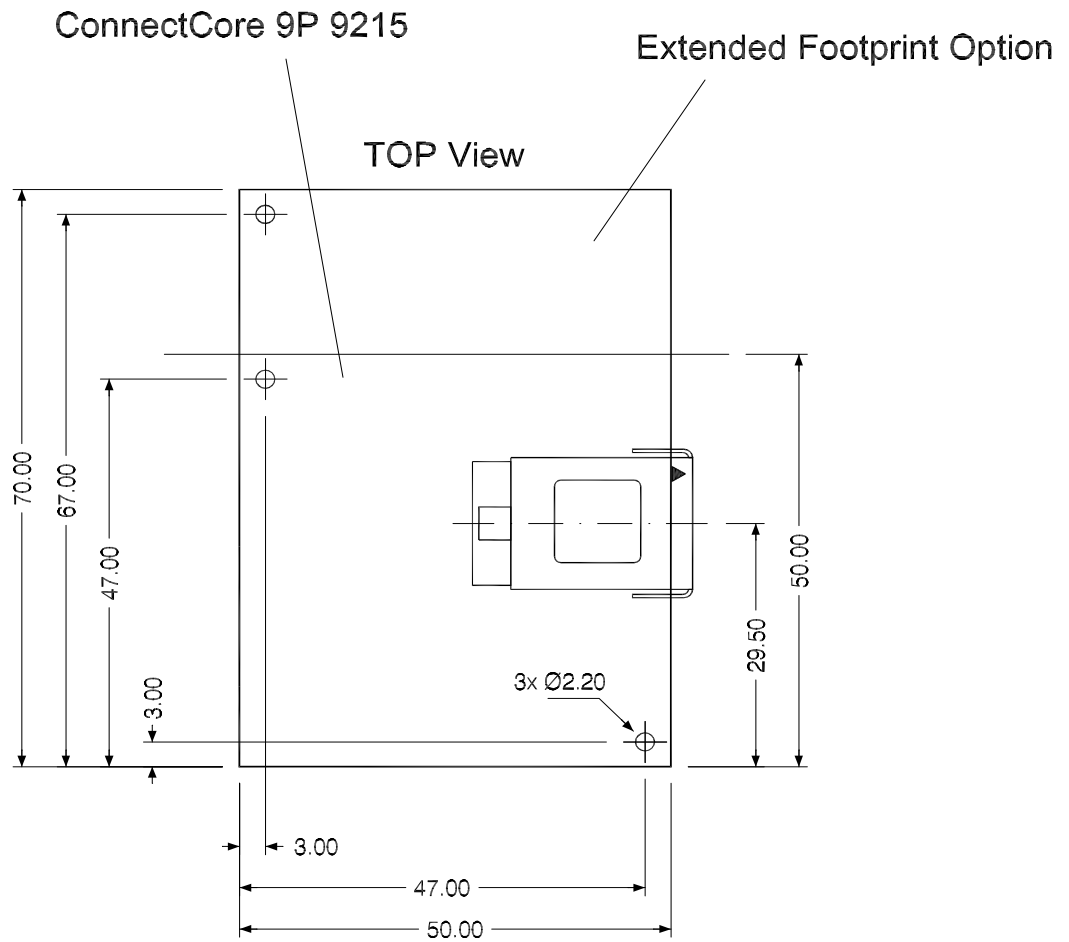


Layout recommendation

Below are the mechanical dimensions of the standard NS9210 Processor Module.

The layout of the NS9210 Processor Module JumpStart board is consistent with the recommendations from Berg/FCI for the mating connector (Berg/FCI 61083-084409LF). There is a 41mm separation between the two module connectors. Drawing number 61083 on the FCI web page: www.fciconnect.com shows the manufacturer recommended layout.



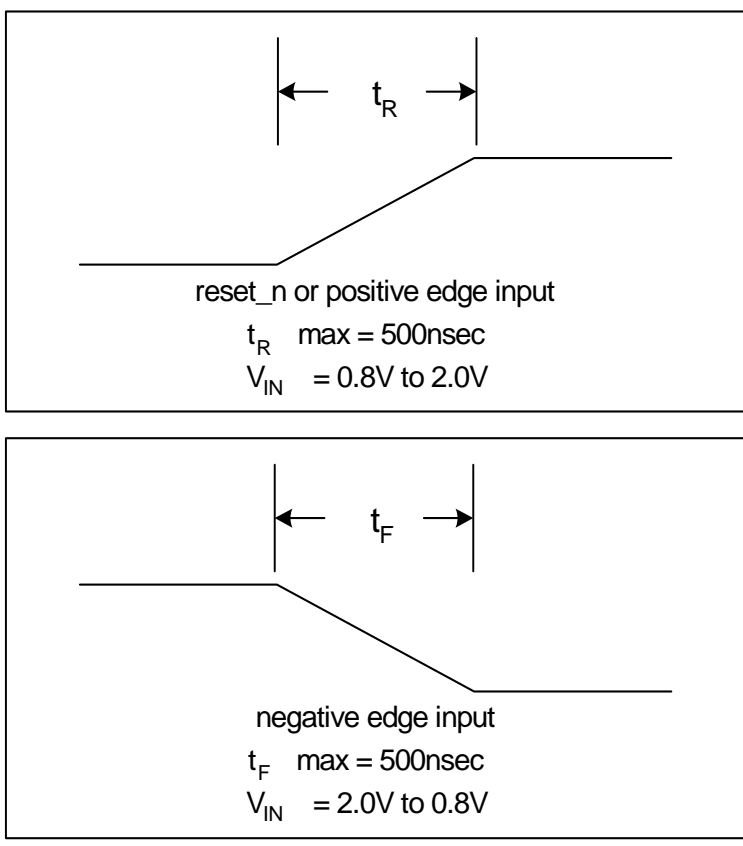


Device	Berg/FCI connector
NS9210 Processor Module	61082-081409LF
NS9210 Processor Module JumpStart board (mating connector on the base board)	61083-084409LF

Reset and edge sensitive input timing requirements

The critical timing requirement is the rise and fall time of the input. If the rise time is too slow for the reset input, the hardware strapping options may be registered incorrectly. If the rise time of a positive-edge-triggered external interrupt is too slow, then an interrupt may be detected on both the rising and falling edge of the input signal.

A maximum rise and fall time must be met to ensure that reset and edge sensitive inputs are handled correctly. With Digi processors, the maximum is 500 nanoseconds as shown:



On the NS9210 Processor Module JumpStart there was a measurement of 220ns rise time and 10ns fall time.

Appendix B: Certifications

The NS9210 Processor Module product complies with the standards cited in this section.

FCC Part 15 Class B

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Radio Frequency Interface (RFI) (FCC 15.105)

The NS9210 Processor Module has been tested and found to comply with the limits for Class B digital devices pursuant to Part 15 Subpart B, of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Labeling Requirements (FCC 15.19)

This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

If the FCC ID is not visible when installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module FCC ID. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: MCQ-50M1355/ IC: 1846A-50M1355".

Modifications (FCC 15.21)

Changes or modifications to this equipment not expressly approved by Digi may void the user's authority to operate this equipment.

Industry Canada

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de la class B prescrites dans le Reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.



Declaration of Conformity

(In accordance with FCC Dockets 96-208 and 95-19)

Manufacturer's Name: Digi International
Corporate Headquarters: 11001 Bren Road East
Minnetonka MN 55343
Manufacturing Headquarters: 10000 West 76th Street
Eden Prairie MN 55344

Digi International declares, that the product:

Product Name NS9210 Processor Module
Model Numbers: FS-3029
FS-3038

to which this declaration relates, meets the requirements specified by the Federal Communications Commission as detailed in the following specifications:

- Part 15, Subpart B, for Class B equipment
- FCC Docket 96-208 as it applies to Class B personal
- Personal computers and peripherals

The product listed above has been tested at an External Test Laboratory certified per FCC rules and has been found to meet the FCC, Part 15, Class B, Emission Limits. Documentation is on file and available from the Digi International Homologation Department.

International EMC Standards

The NS9210 Processor Module meets the following standards:

Standards	NS9210 Processor Module
Emissions	FCC Part 15 Subpart B ICES-003
Immunity	EN 55022 EN 55024
Safety	UL 60950-1 CSA C22.2, No. 60950-1 EN60950-1



